Diagnostics

Diagnostics

Overview

This section describes subsystem text messages and diagnostic/utility software tools that can help you evaluate OEC UroView® 2800 Table and Generator performance, calibrate the Table and Generator controls, and isolate Table or Generator failures when they occur.

The UtilitySuite (US) software contains many diagnostic programs to aid in servicing the table and generator. The Field Service Engineer should be familiar with operation of the US/RUT software and other diagnostic software for use with a laptop computer.

VFD Messages

The following paragraphs describe all messages that appear on the Vacuum Fluorescent Display (VFD) in the Collimator Housing and on the VFD in the X-ray Control Panel. These two displays are identical and operate in parallel; what you see on one display also appears on the other display.

Each display consists of four lines of 20 characters each, providing a total of 80 characters. The display is luminescent blue and is readable in all lighting conditions except the brightest direct sunlight.

Some VFD messages provide status only. Other VFD messages announce errors or provide warnings, and suggest appropriate remedial action when the system operator can normally solve the problem. More complex errors describe the principal problem, and then display the message, "CALL SERVICE." Most error messages overwrite any routine technique or table position data that may already be present on the VFDs.

Normal Messages

Line 1 of each VFD normally displays Generator technique information.

Lines 2 and 3 of each VFD normally display table position information in latitude and longitude. Consult the Table Operator Manual (00-882096-01) for instructions on how to interpret table position information.

Line 4 of each VFD normally displays Collimator position information, which consists of the collimated rectangle at the plane of the film cassette. Consult the Table Operator Manual for guidance on how to interpret this information.

Table position and technique messages appear on the VFDs until updated by other messages. Routine Information messages appear for a few seconds, and are then replaced by table position and technique data.

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Diagnostics

The displays blank when idle to prevent burn-in damage to the VFDs. The displays reactivate upon any operator entry or upon any change in system status that would normally be reported on the VFDs.

Error Messages

When necessary, Table or Generator error messages displace table position information beginning on line 2 of each VFD. Suggested remedial action sometimes appears beginning on line 3 and continues on to line 4 if necessary, displacing Collimator position information. If the message is larger than 20 characters, the display scrolls continuously so you can read the whole message without having to press a key.

Table Error Messages appear until the user corrects the error. Table errors have no associated audible alarms.

Generator and Collimator Error Messages also appear on the VFDs. There are six kinds of Generator and Collimator error messages, some of which generate audible alarms:

1. **Alternating Messages** display alternately with the technique. The message appears for two seconds, and then the technique appears for two seconds. This kind of message appears only when X-rays are not being generated. If the error occurs during X-rays, the current X-ray finishes and then the error message appears.

2. **Timed Messages** display once for two seconds, and then each VFD goes blank. This type of message appears only when X-rays are not being generated. If the error occurs during X-rays, the current X-ray finishes and then the error message appears.

3. **User Action** messages require user intervention, such as pressing or releasing a Table Control Panel key, to clear the message. Software disables X-rays for the duration of the problem. If the error occurs during X-rays, the current X-ray finishes and then the error message appears.

4. **Disable X-ray** messages appear on each VFD until the cause of the error goes away. You cannot clear these messages by pressing a button or key. The Generator cannot produce X-rays when this type of message is present. If the error occurs during X-rays, the current X-ray finishes and then the error message begins.

5. A **Generator System Shutdown** message disables the Generator immediately and completely. Any in-progress X-rays immediately terminate. In most cases, table movement will still be permitted, making it possible to level and unload the table. You must re-boot the system before you can use it again.

6. **Full System Shutdown** messages halt the OEC UroView® 2800 system software, making both Generator operation and Table movement impossible. You must re-boot the system before you can use it again.

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Message Priority

VFD messages have the following priority:

1.   System Shutdown

2.   Generator System Shutdown

3.   User Action

4.   Disable X-ray

5.   Timed

6.   Alternating

7.   Operator prompts

8.   Generator Technique and Table Position

In cases where there are multiple messages of the same priority, the VFD displays the messages in the order they are received.

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Alphabetic VFD Message Listing

The following table lists all possible VFD messages in alphabetical order with Utility Suite type numbers. (Refer to the *Generator Events Log* section to access the Generator Events Log.)

If the message is less than 8 characters, it is displayed in the center of the VFD field between any technique values on display. If more than 8 characters, and less than 20, it is displayed as shown. If more than 20 characters, the message will scroll. %S = indicate a displayed number. (Displayed numbers are in decimal notation. Refer to the Generator Error Messages portion of this manual section for Hexadecimal equivalents.

Utility Suite Type numbers 30001 through 30043 are displayed on line 1, Generator Errors (unless otherwise noted); 30044 through 30060 on Line 2, Table Errors. Types 30061 through 30089 are Table Information messages.

Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30044 ACCESSORY INSTALLATION ERROR	Table Error Unknown table accessory incorrectly installed. Foot Extension or Micturation Seat is incorrectly installed. TBL UNKNOWN ACCESSORY INSTALLATION ERROR	Correctly install Foot Extension or Micturation Seat or other accessory.

Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30074 ALL SAVED POSITIONS ARE CLEARED	<u>Table Information</u> Message appears when you press the SAVE key for longer than five seconds; indicates you have cleared all saved memories. No logged text.	N/A
30001 ANODE IS HOT - %s	<u>Alternating</u> Appears when X-ray tube anode or housing is at 82 - 99% of rated maximum or hotter. Message shows percentage of heat capacity used. Includes audible alarm. Clears when anode or housing cools to 80% of rated maximum. HLF and Film exposures are blocked. ANODE IS HOT	Allow X-ray tube to cool. (See also Generator Error Messages in this manual section.)

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Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30002 ANODE IS WARM - %s	Alternating Appears when X-ray tube anode or housing reaches 72 - 80% of rated maximum. Message shows percentage of heat capacity used. No audible alarm. ANODE IS WARM	Allow X-ray tube to cool. (See also Generator Error Messages in this manual section.)
30003 ARMED	Generator Information Message appears after operator presses the FILM key and before the operator takes the film shot. No logged text.	N/A

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Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30055 CALL SERVICE - %s (line 2)	Table Error 43-TBL XRAY COVER COLLISION 31-TBL BANANA ARM COLLISION 50-TBL FU1 FREQUENCY PROBLEM 111-TBL OEC CONTROL COMM FAIL 179-TBL MEM VERSION ERR EPROM 180-TBL MEM CHECKSUM ERROR EPROM	
30045 CASSETTE DOOR OPEN	<u>Table Error</u> Cassette handler door is open. CASSETTE DOOR OPEN	Close cassette handler door.
30046 CASSETTE NOT READY	<u>Table Error</u> Film mode is started but there is no cassette in the cassette handler. CASSETTE NOT READY	Install film cassette in cassette handler

Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30004 COLLIMATOR ADC ERROR - CYCLE POWER	<u>Generator System Shutdown</u> Occurs when analog-to-digital converter fails in sampling and/or conversion as it reads a collimator pot or wrong cassette size. COLLIMATOR ADC ERROR	Reset system. If message persists, check suspect ADC for proper operation.
30005 COLLIMATOR CAL REQUIRED - PRESS ALARM RESET	<u>User Action</u> Appears when software detects that collimator has not been calibrated. COLLIMATOR CAL REQUIRED	Perform collimator calibration with Utility Suite.
30007 COLLIMATOR CONTROL PANEL ERROR	<u>Shut down</u> Collimator Control Panel is defective, keys stuck, etc. Control lines not read correctly. System shut down. COLLIMATOR CONTROL PANEL ERROR	Reboot system. Replace Collimator Control Panel.

Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30008 COLLIMATOR PANEL KEY STUCK. RELEASE . PRESS ALARM RESET.	User Action Occurs when two keys are pressed at the same time. Disables X-rays. COLLIMATOR PANEL KEY STUCK	Release the pressed key and press another key to continue.
30009 COLLIMATOR POTENTIOMETER ERROR - CYCLE POWER	Generator System Shutdown Potentiometer in collimator checked bad during system initialization. COLLIMATOR POTENTIOMETER ERROR	Reset system. If message persists, check suspect pot for faulty wiper contact or other problems.
30011 COLLIMATOR TOO LARGE	Alternating. Also disables X-rays in Film Mode Appears when magnification size changes and collimator does not follow the change correctly. COLLIMATOR TOO LARGE	Reset system. If message persists, check for stuck collimator.

Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30010 COLLIMATOR STUCK	<u>Alternating</u> Software determines collimator has not moved after command. COLLIMATOR STUCK	Reboot the system. Check and/or replace collimator.
30006 COLLIMATOR UNSTABLE	<u>Alternating</u> Message appears when either collimator position is being continually corrected. (More than 10 times since power up) COLLIMATOR UNSTABLE	Replace collimator.
30063 CROSS = %s	<u>Table Information</u> Lateral position from Center Point in inches or cm. No logged text.	N/A
30062 CROSS AXIS CENTERED	<u>Table Information</u> Tabletop is at center of lateral motion. No logged text.	N/A

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Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30013 DATA ERROR	<u>Disable X-ray</u> Non-volatile data stored for generator software is corrupt. DATA ERROR	Restart system. Troubleshoot problem if error persists. Check memory.
30064 DOWN MOTION LIMITED	<u>Table Information</u> Micturation seat or leg extension is too close to floor. No logged text.	Down motion stopped due to Calculated Motion Limit. Remove any accessory before moving the table further downward.
30026 EXPOSURE ERROR %s – PRESS ALARM RESET	<u>User Action</u> Film shot exposure error. EXPOSURE ERROR %s	Release X-ray switch and try another exposure. (See also Generator Error Messages in this manual section.)
30014 FAST STOP BUTTON PRESSED – UNLOCK THE BUTTON TO CONTINUE	<u>Disable X-ray</u> Fast Stop button is active, preventing X-rays. FAST STOP BUTTON PRESSED	Unlock Fast Stop button to continue making X-rays.

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Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30050 FILM FAILURE - %s	<u>Table Error</u> Can't move film transport motor. X-ray Arm and Cassette not centered during film mode request. 36-TBL IMAGE CHAIN NOT CENTERED 134-TBL FLUORO READY RELAY ERROR	1. Check film transport mechanics for jams and foreign objects. 2. Check film transport motor winding continuity. 3. Check film transport drive circuitry for proper signals. 4. Make sure power is available to film transport drive circuitry.
30068 FILM MODE READY	<u>Table Information</u> Image Chain Assembly has reached the center position and is ready for a film shot. No logged text.	N/A
30015 FLUORO ALARM (Not displayed)	<u>User Action</u> Occurs at the end of each 5 minutes of accumulated fluoro time. Disables X-rays at the end of 10 minutes of accumulated fluoro time. No logged text.	Press the ALARM RESET button. Press the ALARM RESET button for approximately two seconds to reset the exposure time to zero and silence the alarm.

Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30051 FLUORO FAILURE	Table Error X-ray exposure ready relay error on startup. TBL FILM RELAY ERROR	Cycle power
30066 FOOT EXTENSION IS AT MINIMUM HEIGHT	Table Info Foot extension cannot be lowered further. No logged text.	N/A
30024 GEN APPLICATION ERROR %s – PRESS ALARM RESET	User Action Generator application error GEN APPLICATION ERROR %s	Press alarm reset to acknowledge error message. (See also Generator Error Messages in this manual section.)
30031 GEN SYSTEM ERROR – CYCLE POWER	Shutdown Generator System Error. GEN SYSTEM ERROR	Cycle power
30025 GENERATOR COMM FAILURE %s - PRESS ALARM RESET	User Action Generator communication error. GENERATOR COMM FAILURE %s	Press alarm reset to acknowledge error message. (See also Generator Error Messages in this manual section.)

Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30027 HARDWARE ERROR %s – PRESS ALARM RESET	<u>User Action</u> Generator hardware error. HARDWARE ERROR %s	Press alarm reset to acknowledge error message. (See also Generator Error Messages in this manual section.)
30028 HEATER ERROR %s – PRESS ALARM RESET	<u>User Action</u> Generator heater error. HEATER ERROR %s	Press alarm reset to acknowledge error message. (See also Generator Error Messages in this manual section.)
30085 HEIGHT = %s	<u>Table Information</u> Table height from floor expressed in inches or cm. No logged text.	N/A
30021 HLF OVERTIME	<u>User Action</u> Occurs at maximum fluoro time for patient exposure. Disables X-rays. HLF OVERTIME	Reset alarm to continue.

Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30018 HOUSING IS HOT - %s	Alternating Message Occurs after prolonged use in film or fluoro mode. The tube is within 82 - 90% of its rated heat capacity. Blocks HLF and Fluoro exposures. HOUSING IS HOT - %s	Allow the tube to cool before the next use. See operator's manual for tube cooling time chart. (See also Generator Error Messages in this manual section.)
30020 HOUSING OVERHEATED	Disable X-ray Occurs after extremely prolonged use. Indicates the tube is near or has passed the rated heat capacity. Temperature is at 100% of rated heat capacity. System shutdown, table operable. X-rays disabled. HOUSING OVERHEATED	Allow the tube to cool before further exposures can be made. Reboot system. See operator's manual for tube cooling time chart.
30019 HOUSING IS WARM - %s	Alternating Message Occurs as the tube is used in film or fluoro mode. The tube is within 72 - 82% of its rated heat capacity. HOUSING IS WARM - %S	Exposures may continue, but the operator should be aware of tube heating. (See also Generator Error Messages in this manual section.)

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Utility Suite Type Number **Exact Displayed Text**	Message Type, Description, Logged Text (if any)	**Corrective Action Required**
30012 LAT = %s (" or cm) LONG = %s (" or cm) (" = inches)	Table Information Lateral or longitudinal projection of table (cm rounded to nearest cm). (Line 4 – Collimator Message) LAT = %s LONG = %s	N/A
30070 LOAD POSITION REACHED	Table Information Table is at programmed patient load position No logged text.	N/A
30071 LONG = %s	Table Information Longitudinal position from Center Point in inches or cm. No logged text.	N/A
30065 LONG MOTION LIMITED	Table Information Longitudinal motion stopped due to calculated motion limit. No logged text.	N/A

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Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30022 mAs LIMITED	User Action Generator mAs is limited in AEC Mode. MAS LIMITED	Adjust mAs.
30023 mAs = %s	Timed No alarm. mAs information appears after film shot is complete. MAS = %s	N/A
30072 MAXIMUM HEIGHT	Table Information Table is at maximum elevation. No logged text.	N/A
30073 MAXIMUM TILT	Table Information Table is at maximum tilt (± 20 degrees) No logged text.	N/A
30075 MINIMUM HEIGHT	Table Information Table is at minimum elevation. No logged text.	N/A

Alphabetic List of VFD Messages		
Utility Suite Type Number Exact Displayed Text	Message Type, Description, Logged Text (if any)	Corrective Action Required
30048 MOTION FAILURE - %s	Table Error Table travel is blocked in the desired direction. Logged text by failure number: 51-TBL LATERAL MOTOR PROBLEM 52-TBL FILM TRANSPORT MOTOR PROBLEM 53-TBL LONG MOTOR PROBLEM 54-TBL TILT MOTOR PROBLEM 55-TBL IMAGE CHAIN MOTOR PROBLEM 56-TBL ELEVATION MOTOR PROBLEM 62-TBL TILT MOTION FAILURE – R1 (Cont.)	51-Motor M6 problem – Table Lateral. 52-Motor M5 Problem – Cassette/Film Transport 53-Motor M4 Problem – Table Longitudinal. 54-Motor M3 Problem – Vertical/Tilt B. 55-Motor M2 Problem – X-ray Arm Assembly. 56-Motor M1 Problem – Vertical/Tilt A. 62-Tilt/Elevation Motion Blocked - Potentiometer R1 problem. 63-Tilt/Elevation Motion Blocked - Potentiometer R3 problem. 64-Lateral Motion Blocked – Potentiometer problem. 65-Longitudinal Motion Blocked - Potentiometer problem. 66-X-ray Arm Assembly Motion Blocked – Potentiometer problem. 70-Film Transport Motion Blocked – Potentiometer problem. 71-Limit Switch or gearbox overheating Problem M1 or M3. (Cont.)

Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
Motion Failure - %s (Cont.)	63-TBL ELEVATION MOTION FAILURE – R3 64-TBL LATERAL MOTION FAILURE 65-TBL LONG MOTION 72-TBL IMAGE CHAIN LIMIT OR OVERHEAT 66-TBL IMAGE CHAIN MOTION FAILURE 70-TBL FILM TRANSPORT MOTION FAILURE 71-TBL TILT/ELEVATION LIMIT OR OVERHEAT 73-TBL LONG LIMIT OR OVRHEAT 101-TBL FREQ CONVERT 0 ERROR 102-TBL FREQ CONVERT 1 ERROR	72- Limit Switch or gearbox overheating Problem M2. 73- Limit Switch or gearbox overheating Problem M4. 101-Freq Converter 0 for tilt/vertical system out of order. 102-Freq Converter 1 for tilt/vertical, longitudinal, cassette out of order. Also: 1. Check for table overload or inadvertent contact with another object. 2. Check elevation drive mechanics for jams and foreign objects. 3. Check elevation pot for proper tracking. 4. Check elevation motor winding continuity. 5. Check elevation drive circuitry signals. 6. Make sure power is available to elevation drive circuitry.

Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30076 MOVING TO LOAD POSITION	<u>Table Information</u> Table is moving to programmed patient load position. No logged text.	N/A
30077 NO POSITION %s WAS SAVED TO RECALL	<u>Table Information</u> Occurs when you press the RECALL button and there are no saved positions in memory. No logged text.	N/A
30078 NO POSITIONS %s WERE SAVED TO RECALL	<u>Table Information</u> Occurs when you press the RECALL button on the footswitch and no positions are saved in memory. No logged text.	N/A
30033 PLEASE WAIT	<u>Disable X-ray</u> Occurs as the system is loading data as commanded by the operator. PLEASE WAIT	Wait until the system has made adjustments and turns off the message.

Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30079 POSITION %s REACHED	Table Information Appears when table reaches a recalled position. No logged text.	N/A
30080 POSITION %s SAVED	Table Information Appears when you press the SAVE key and then a numeric key. Indicates table has saved that table position. No logged text.	N/A
30029 POWER SUPPLY ERROR %s – PRESS ALARM RESET	User Action Generator power supply error. POWER SUPPLY ERROR %s	Press alarm reset to acknowledge message. (See also Generator Error Messages in this manual section.)
30081 RECALLING POSITION %s	Table Information Appears when you press the RECALL button and then a number key. Table then moves to recalled position. No logged text.	N/A

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Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30034 RELEASED EARLY	<u>Timed</u> During a film exposure, the X-ray On key was released before the desired mAs was reached. RELEASED EARLY	1. Replace the film. 2. Press the X-ray On key until the system terminates the exposure.
30082 REMOVE CASSETTE	<u>Table Information</u> Appears when film shot is complete. Remove cassette from table. No logged text.	N/A
30035 ROOM DOOR OPEN	<u>Disable X-ray</u> The room door is part of the system interlocks. ROOM DOOR OPEN	Close the room door to enable x-ray exposures to be made.
30030 ROTOR ERROR %s – PRESS ALARM RESET	<u>User Action</u> Generator Rotor Error. ROTOR ERROR %s	Press alarm reset to acknowledge error message.

Alphabetic List of VFD Messages		
Utility Suite Type Number Exact Displayed Text	Message Type, Description, Logged Text (if any)	Corrective Action Required
30083 TABLE CAL REQUIRED	Table Information Table must be calibrated to relate ADC units to linear measure. No logged text.	Calibrate Table as described elsewhere in this chapter.
30036 TABLE COMMUNICATIONS FAILED	Table Error Occurs if the workstation cable is unplugged. Disables X-rays. TABLE COMMUNICATIONS FAILED	Power up the table and make sure all cables are securely plugged in.
30053 TABLE FOOTSWITCH KEY ERROR	Table Error Key on table control footswitch is probably being pressed at boot up. TBL FOOTSWITCH KEY ERROR	Don't touch table control footswitch during boot up. If error persists, disconnect footswitch during boot up. If error disappears with footswitch disconnected, replace the footswitch.
30054 TABLE HANDSWITCH KEY ERROR	Table Error Key on table handswitch is probably being depressed at boot up. TBL HANDSWITCH KEY ERROR	Don't touch table handswitch during boot up. If error persists, disconnect handswitch during boot up. If error disappears with handswitch disconnected, replace handswitch.

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Utility Suite Type Number Exact Displayed Text	Message Type, Description, Logged Text (if any)	Corrective Action Required
30037 TABLE IN SERVICE MODE	Disable X-ray Table in service mode and not ready for use. TBL IN SERVICE MODE	Return table to normal mode after service has been performed.
30084 TABLE LAT AT LIMIT	Table Information Table top is at extreme left or right lateral position. No logged text.	N/A
30086 TABLE LONG AT LIMIT	Table Information Table top is at extreme head or foot longitudinal position. No logged text.	N/A
30087 TABLE IS LEVEL	Table Information Message appears when table tilt is at 0 degrees. No logged text.	N/A
30052 TABLE WARNING (Not displayed)	Table Error TBL FILM MODE RELEASE EARLY	N/A

Alphabetic List of VFD Messages		
Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30038 TEMP. SENSOR FAIL	<u>Alternating</u> Occurs when the software fails to obtain a reading from the tube temperature sensor. TEMP. SENSOR FAIL	Press alarm reset to continue with exposures.
30032 THERMAL ERROR %s	<u>User Action</u> Generator thermal error. THERMAL ERROR %s	Cycle power to system and reboot. If message persists, check for overheating in generator. (See also Generator Error Messages in this manual section.)
30089 TILT = %s	<u>Table Information</u> Current table tilt angle in degrees. No logged text.	N/A
30088 UROVIEW TABLE READY	<u>Table Information</u> Message appears when table passes its self-tests and initializes properly on boot up. No logged text.	N/A
30059 VSC COMMUNICATIONS FAILED (Not displayed)	<u>Table Error</u> VSC COMMUNICATIONS FAILED	N/A

Alphabetic List of VFD Messages		
Utility Suite Type Number Exact Displayed Text	Message Type, Description, Logged Text (if any)	Corrective Action Required
30041 WORKSTATION COMMUNICATION FAILED	Disable X-ray Workstation hardware or software error. WORKSTATION COMMUNICATION FAILED	
30067 X-RAY ARM AT LIMIT	Table Information Image Chain Assembly is at extreme head or foot position. No logged text.	N/A
30069 X-RAY ARM = %s	Table Information Displayed report of Image Chain position in inches or centimeters. No logged text.	N/A
30042 X-RAY ARM NOT READY	Disable X-ray Message appears when the arm is not locked in X-ray position. X-RAY ARM NOT READY	Lock X-ray arm in X-ray position.

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Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30047 X-RAY BLOCKED	<u>Disable X-ray</u> Image Intensifier has encountered an obstacle in its downward movement. X-RAY BLOCKED	Remove obstacle that blocks Image Intensifier's downward movement.
30040 X-RAY CONTROL PANEL ERROR	<u>User Action</u> X-RAY CONTROL PANEL ERROR	Reset the system.
30039 X-RAY CONTROL PANEL KEY STUCK – RELEASE PRESS ALARM RESET	<u>User Action</u> X-RAY CONTROL PANEL KEY STUCK	Release the control panel key and press another key to continue making exposures.
30043 X-RAY DISABLED	<u>Disable X-ray</u> X-ray cannot be commanded. X-RAY DISABLED	Restart system.
30017 X-RAY SWITCH STUCK	<u>User Action</u> X-RAY SWITCH STUCK	Check and replace X-ray switch if necessary.

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Utility Suite Type Number **Exact Displayed Text**	**Message Type, Description, Logged Text (if any)**	**Corrective Action Required**
30016 X-RAY SWITCH SECURITY ERROR	<u>Generator System Shutdown</u> Message appears when Generator detects a mismatch between the X-ray security line and the X-ray controls. Also occurs when the Generator detects that the X-ray command line is active, but the Generator is not ready for an exposure. X-RAY SWITCH SECURITY ERROR	Restart system. If error persists, troubleshoot security line logic.

Table Diagnostics

The URO Service Tool software distributed via 3.5-inch disk has diagnostic tests that can be used to access test inputs, analog motor data, function control, software version and event codes.

Setup

1. Access the table electronics located on the left hand side of the Tower. Access is dependant on whether the table configuration is left-hand or right-hand.

    On left-hand table configurations move the generator to access the electronics.

    On right-hand table configurations, remove the left Tower to access the electronics.

2. Remove the eight nuts and washers (four each side) that secure the EMI Shield covering the Table Electronics. Table electronics are located above the M1 motor.

3. Connect the RS-232 serial cable (female-to-male) between the serial port on your laptop and the 9-pin sub D serial port (X7) on the Table Motion CPU PCB.

4. Insert the URO Service Tool disk into the laptop's 3.5-inch floppy disk drive.

URO Service Tool Software

1. Access the Utility Suite software and click on the "Tools" pull-down menu and click to select "Motron Tools."
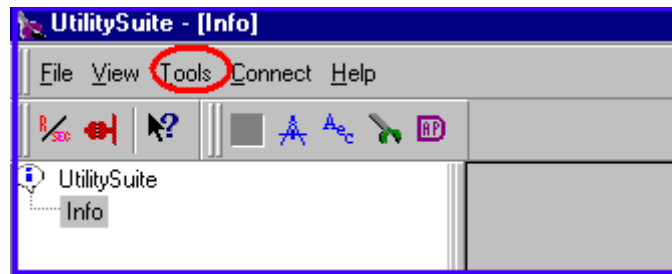
2. When the disclaimer window is displayed, click on the *I Agree* button.

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3. When the COM Port window appears, configure the communications as indicated in the table:
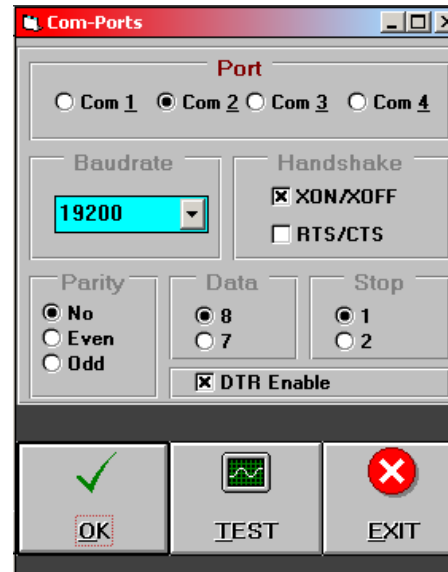
COM Parameters	Value/Setting
baud rate	19200
Handshake	XON/XOFF
Parity	No
Data	8
Stop	1

4. Click the *Test* button to display the available COM ports. Note which COM ports are available and click *OK*.
5. On the COM Ports window, select an available COM port from the combo-box.
6. Click the *Ok* button.
7. On the *Ok Now?* window, click *Yes*.

8. On the *Save Configuration File?* window, click *No*.

9. When the UROMAT 3000 Service & Installation Tool screen (shown below) appears, click on the *Parameters* button.

UROMAT 3000 Service & Installation Tool

10. When the Open window appears, select the *.hpp file from the 3.5-inch diskette. If a *.hpp file is not available, select the *.hpo file.

*Note: The *.hpp file will be on the disk if the *.hpo file was previously opened, edited and saved. When the edited data is saved, it is saved as a *.hpp file. The *.hpo file contains default calibration data.*

11. When the *Firmware Information Screen* appears, click *OK* and then the *Parameter List* window will appear.

Caution: *Use care when changing values in the Parameter List. Incorrect values may cause the table to malfunction.*
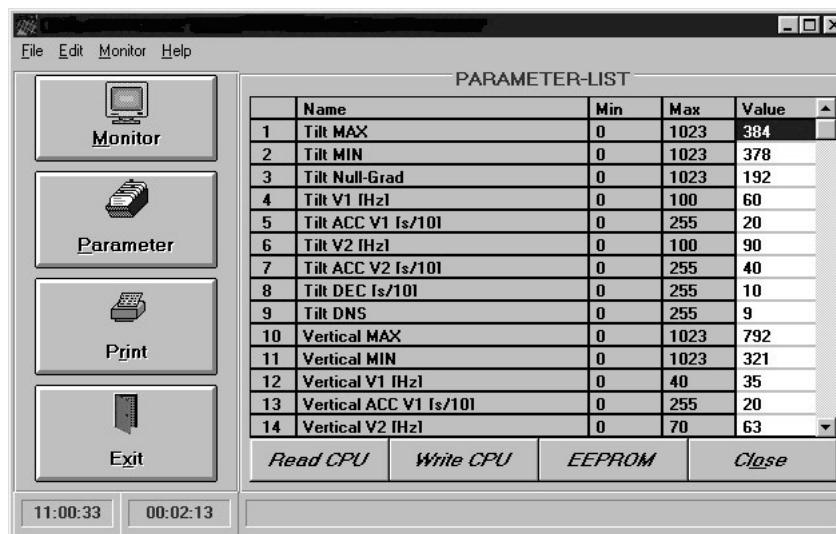
Parameter List Window

12. Flip the Service switch located on the Table Motion CPU PCB to the up position. The LED should stop blinking.

13. Click on the *Read CPU* button to load the established parameters from the table into the Parameter List window.

14. If the transfer was successful click *Ok*. If a Timeout Error message is displayed, check the serial cable connection and Service Switch status.

15. When the Firmware Information window displays, click on *Ok*.

16. Click on the *Monitor* button.

Diagnostics

17. The Service Menu window will be displayed:
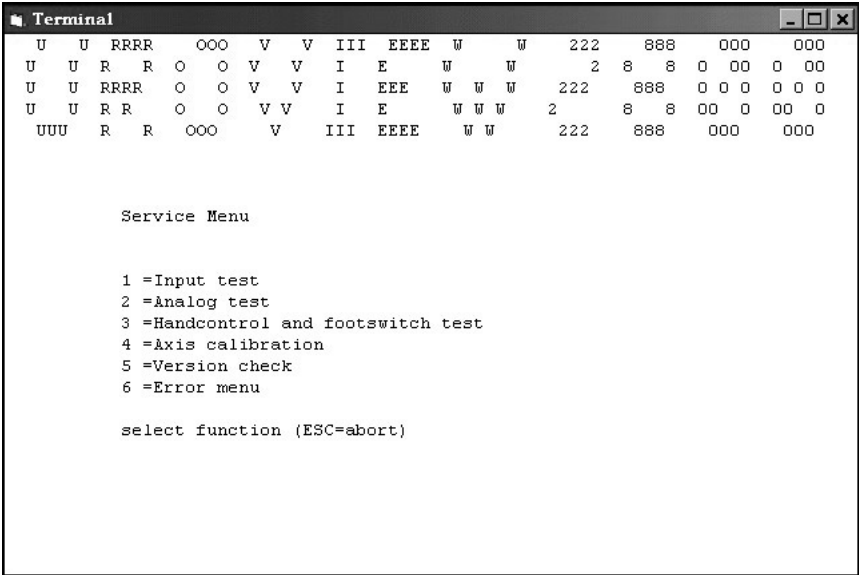
Service Menu

Diagnostics

___

Input Test

1. With the Service Menu window displayed, select the Input Test by pressing 1 on your laptop keyboard.

2. Check the functionality of any of the listed inputs.

Note: For example, open the Film Tray door (BUCKY) and the status will change from 0 to 1. English names of input tests are identified in parenthesis.

3. Press any laptop computer key to exit.

```
Terminal                                                        _ □ ×
Input-Test


P1.0 CRASH_BV (CRASH_II)  = 0   P4.2 NOTAUS5V (EMERGENCY_STOP)    = 0
P1.1 CRASH_TA (CRASHARM)  = 0   P4.3 POS_TRAG (POS_ARM) .......   = 0
P1.4 POS_KASS (POS_CASS)  = 0   P4.4 I_AUFN   (I_EXPOSURE) ....   = 1
P1.5 RES_P15  (SPARE)     = 1   P4.5 I_DURCH  (I_FLUOROSCOPY) .   = 1
P1.6 RES_P16  (SPARE)     = 1   P4.6 BLEND_ZU (COLLIM. CLOSED)    = 1
P1.7 TAST_5V  (KEY_SAFE)  = 1   P4.7 SERVICE  (SERVICE) .......   = 1

152 K_M1      (K1_M1)     = 1   160 BUCKY     (BUCKY) .........   = 0
153 K_M2      (K2_M2)     = 1   161 MIKTION   (MICTURATION_SEAT)  = 1
154 K_M3      (K3_M3)     = 1   162 VERLAENG  (T_EXTENSION) ...   = 1
155 K_M4      (K4_M4)     = 1   163 ZUBH_OK   (ACCESSORY_OK) ..   = 1
156 K_M5      (K5_M5)     = 1   164 18x43mm   (7x17') .........   = 1
157 K_M6      (K19_M6)    = 1   165 24x30mm   (10x12') ........   = 1
158 FUO_N>0   (FCO_N>0)   = 1   166 35x43mm   (14x17') ........   = 0
159 FU1_N>0   (FC1_N>0)   = 1   167 30x24mm   (12x10') ........   = 1



Press any key for exit
```
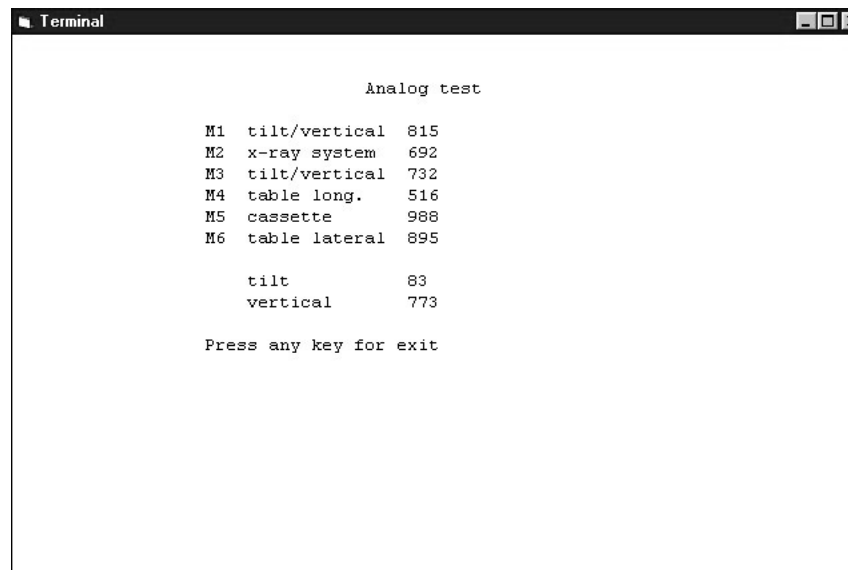
Input Test Window

Analog Test

1. With the Service Mode window displayed, select the Analog Test by pressing 2 on your laptop keyboard.

2   Check values for unusually high or low numbers. High or low numbers may indicate a problem with the motor function listed. The range for each motor function listed is 0 – 1023.

3. Press any laptop computer key to exit.

```
Terminal                                          _ □ ×

                        Analog test

           M1  tilt/vertical  815
           M2  x-ray system   692
           M3  tilt/vertical  732
           M4  table long.    516
           M5  cassette       988
           M6  table lateral  895

               tilt          83
               vertical      773

           Press any key for exit
```

Analog Test Window

Control Test (Handswitch/Footswitch Test)

1. With the Service Mode window displayed, select the Control Test by pressing 3 on your laptop keyboard.

2. Refer to the table on the following page for a listing of handswitch and footswitch keys. When each switch is operated, the corresponding switch number on the screen changes from 0 to 1. More than one switch can be operated at a time.

3. Refer to the diagrams on the following pages for specific key numbers on each control.

4. The handswitch TILT UP and TILT DOWN buttons respond with a 1 in the OEC 7 Tilt Up and OEC 8 Tilt Down Hand position, while the Footswitch TILT UP and TILT DOWN switches respond in Foot switch numbers 20 and 23.

5. Press any laptop computer key to exit.

```
Terminal                                                    _ □ ×
Control-Test


 key  hand  foot  key  hand  foot
 1=    0     0    17=   0     0
 2=    0     0    18=   0     0
 3=    0     0    19=   0     0
 4=    0     0    20=   0     0
 5=    0     0    21=   0     0
 6=    0     0    22=   0     0
 7=    0     0    23=   0     0
 8=    0     0    24=   0     0
 9=    0     0    OEC 1=0
 10=   0     0    OEC 2=0
 11=   0     0    OEC 3=0
 12=   0     0    OEC 4=0
 13=   0     0    OEC 5=0
 14=   0     0    OEC 6=0
 15=   0     0    OEC 7=0
 16=   0     0    OEC 8=0



 Press any key for exit
```
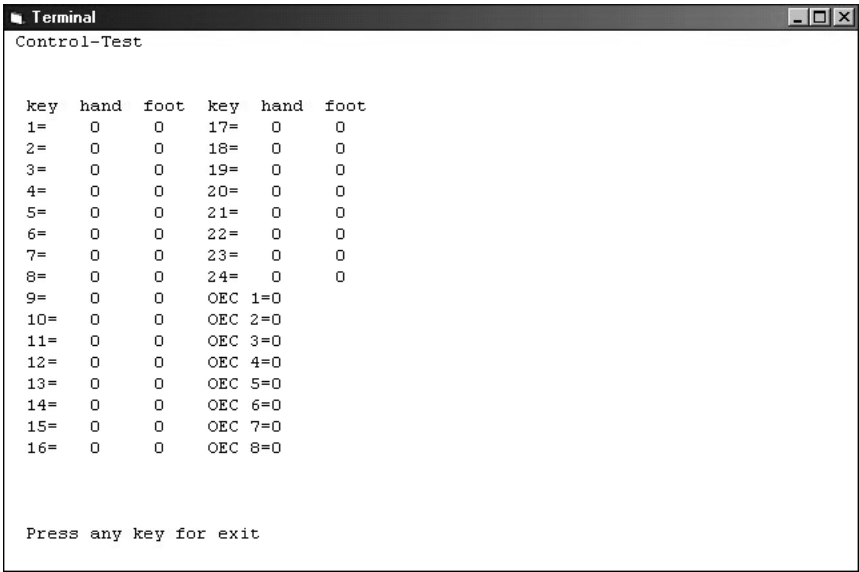
Control Test Window

Note: Depression of the Save key continuously for 5 seconds will clear all stored positions in memory.

Contents   Installation   Service   Schematics   Periodic Maintenance   Illustrated Parts

Handswitch Key Numbers

Contents   Installation   Service   Schematics   Periodic Maintenance   Illustrated Parts

Footswitch Numbers
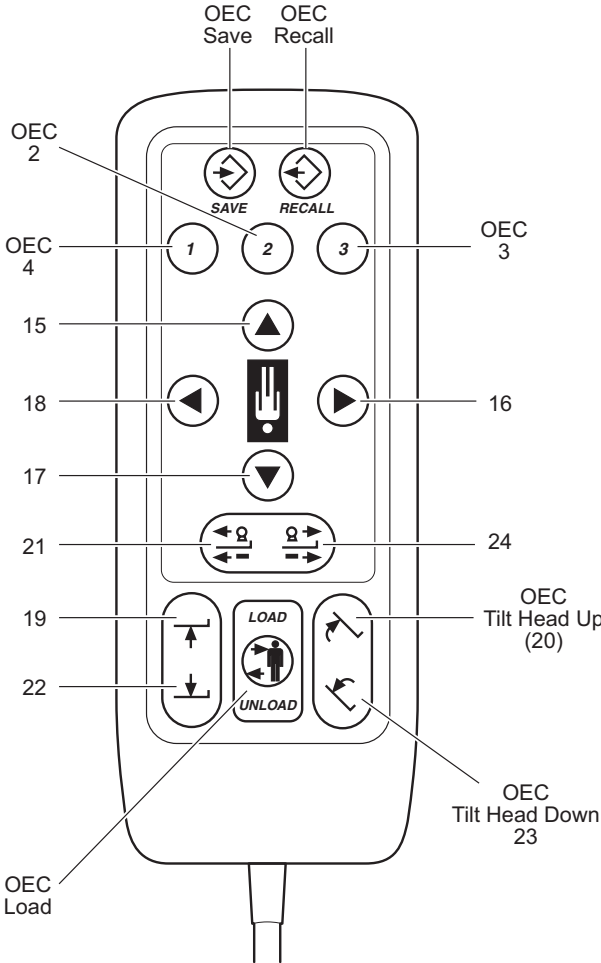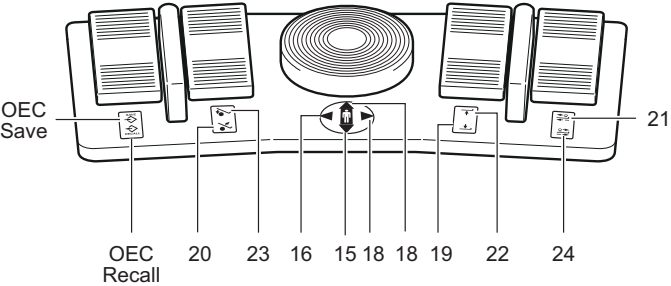
Contents   Installation   Service   Schematics   Periodic Maintenance   Illustrated Parts

Key   **Listing**
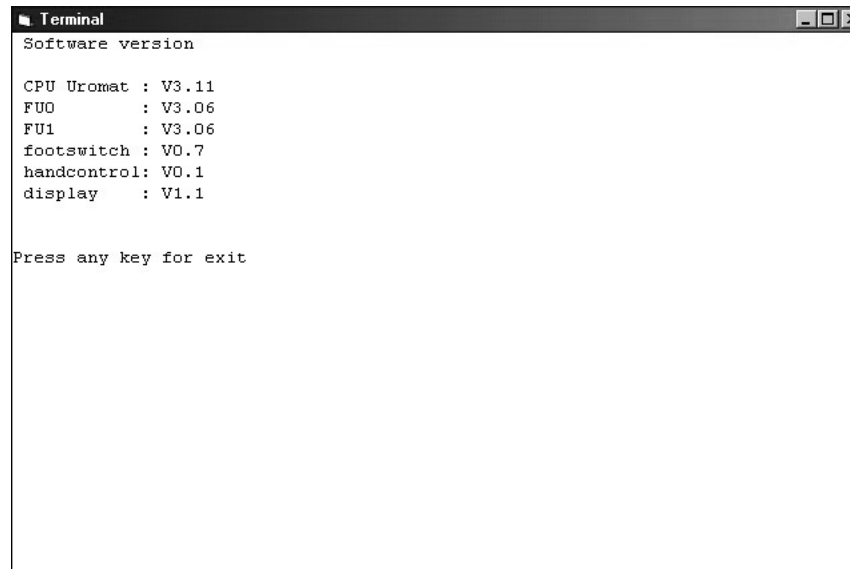
Key number	Action
1 to 14	Not used by OEC UroView® 2800
15	tabletop longitudinal foot down
16	tabletop lateral left
17	tabletop longitudinal head up
18	tabletop lateral right
19	elevation up
20	tilt head up
21	image chain head direction
22	elevation down
23	tilt head down
24	image chain foot direction
OEC 1	Store or Recall Memory Position #1 (Note this key must be preceded by OEC Store or Recall command to be a valid key)
OEC 2	Store or Recall Memory Position # (Note this key must be preceded by OEC Store or Recall command to be a valid key)
OEC 3	Store or Recall Memory Position # (Note this key must be preceded by OEC Store or Recall command to be a valid key)
OEC 4 Load	Move Table to Load Position
OEC 5 Save	Initiate Save Position Sequence – to be followed by key OEC 1 , 2, or 3

Contents   Installation   Service   Schematics   Periodic Maintenance   Illustrated Parts

Key number	Action
OEC 6 Recall	Initiate Recall Position Sequence – to be followed by key OEC 1, 2, or 3
OEC 7 Tilt Up	Head end of table is tilted up
OEC 8 Tilt Down	Head end of table is tilted down

Checking Software Version

1. With the Service Menu window displayed, select the Software Version by pressing 5 on your laptop keyboard.
2. Press any laptop computer key to exit.

```
Terminal                                          _ □ x
Software version

CPU Uromat : V3.11
FU0        : V3.06
FU1        : V3.06
footswitch : V0.7
handcontrol: V0.1
display    : V1.1


Press any key for exit
```

Software Version

Error Menu

1. With the Service Mode window displayed, select the Error Menu by pressing 6 on your laptop keyboard.
2. A table event log will be displayed on the screen.
3. Press any laptop computer key to exit.

```
U   U  RRRR    OOO   U   U  III  EEEE  W      W    222    888    000    000
U   U  R   R  O   O  U   U   I   E     W      W      2   8   8  0  00  0  00
U   U  RRRR   O   O  U   U   I   EEE   W   W  W    222    888  0 0 0  0 0 0
U   U  R  R   O   O   U U    I   E      W W W  2      8   8  00  0  00  0
 UUU   R   R   OOO     U     III  EEEE     W W     222    888    000    000



       Extended Menu


       1 =reset error list
       2 =show error list
       3 =show memory idata
       4 =show memory xdata

       select function (ESC=abort)_
```

Error Menu

Contents   Installation   Service   Schematics   Periodic Maintenance   Illustrated Parts
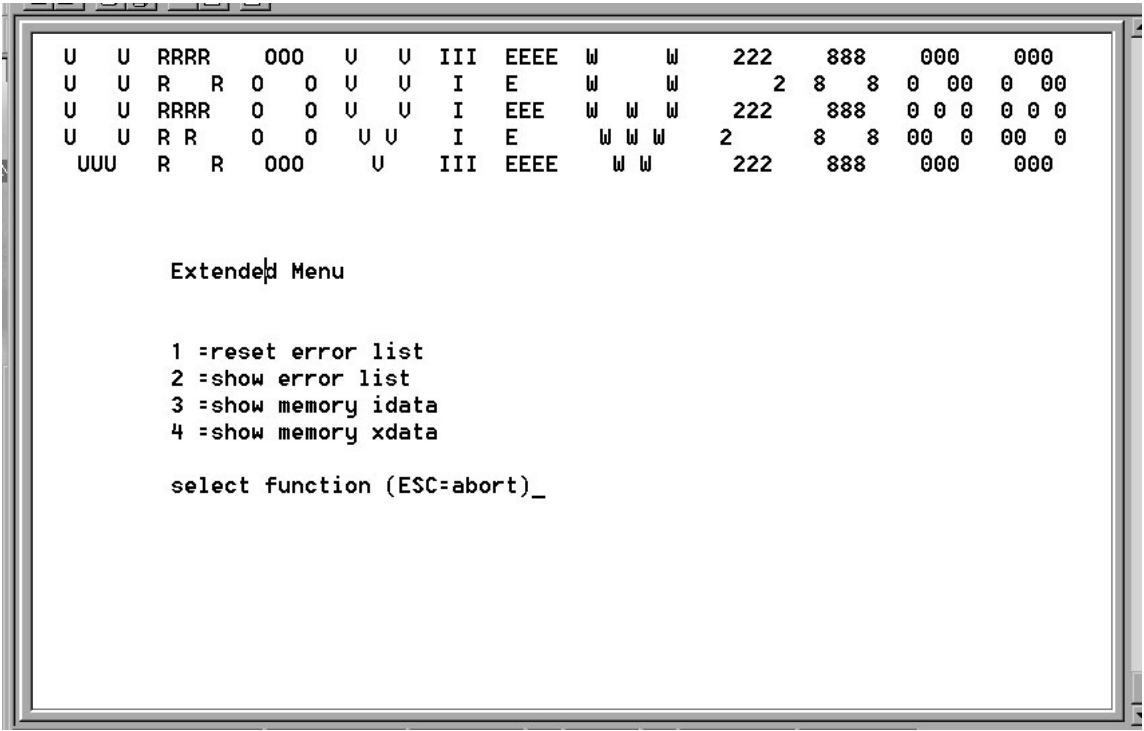
Exiting

1.   Place the Table Motion CPU PCB Service Switch to the down position.
2.   Exit the software.

Contents   Installation   Service   Schematics   Periodic Maintenance   Illustrated Parts

UtilitySuite

Using the UtilitySuite (US) software from an external laptop gives the Field Service Engineer the ability to setup various parameters of the OEC UroView® 2800.

Upon entry to the UtilitySuite, click on the pull-down **Help** menu shown below to review explanations of the various screens and parameters of the UtilitySuite programs as applied to the Uroview® 2800.
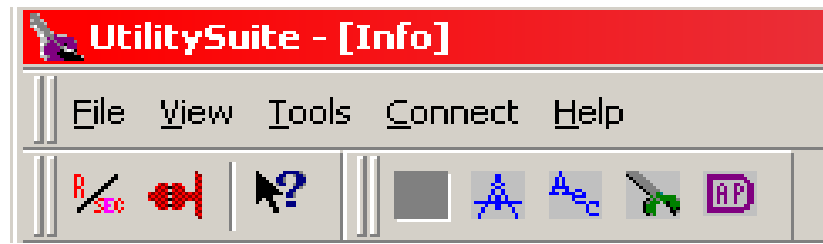
Utility Suite Pull-down Menus

Contents   Installation   Service   Schematics   Periodic Maintenance   Illustrated Parts

Table Setup

Configuration

The Table Parameter values listed below are default values and may be different for various tables and after calibration. They are also dependent upon the table configuration, i.e., patient left, right, film or filmless, and there may be additional values also depending upon machine configuration.

These values may be viewed using the Uro Service Tool in the Utility Suite program.

Caution: *Before any changes are made to these values***, be sure to upload the table residing in the machine and SAVE it.**

Caution should be used in making any changes to the values listed below as table operation could be seriously affected by wrong settings.

Name	Max.	Typ. Value
Tilt MAX	1023	363
Tilt MIN	1023	369
Tilt Null-Grad	1023	188
Tilt V1 [Hz]	100	60
Tilt ACC V1 [s/10]	255	7
Tilt V2 [Hz]	100	90
Tilt ACC V2 [s/10]	255	14
Tilt DEC [s/10]	255	4
Tilt DNS	255	5
Vertical MAX	1023	773

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Vertical MIN	1023	308
Vertical V1 [Hz]	40	35
Vertical ACC V1 [s/10]	255	7
Vertical V2 [Hz]	70	53
Vertical ACC V2 [s/10]	255	14
Vertical DEC [s/10]	255	4
Vertical DNS	255	5
System MAX	1023	623
System MIN	1023	407
System X-ray position	1023	464
System V1 [Hz]	40	40
System ACC V1 [s/10]	255	7
System V2 [Hz]	70	40
System ACC V2 [s/10]	255	14
System DEC [s/10]	255	3
System DNS	255	20
Tabletop long. MAX	1023	955
Tabletop long. MIN	1023	81
Tabletop long. NULL	1023	518
Tabletop long. V1 [Hz]	40	30
Tabletop long. ACC V1 [s/10]	255	7
Tabletop long. V2 [Hz]	70	50
Tabletop long. ACC V2 [s/10]	255	14
Tabletop long. DEC [s/10]	255	3

Tabletop long. DNS	255	5
Tabletop lateral MAX	1023	846
Tabletop lateral MIN	1023	195
Tabletop lateral NULL	1023	522
Tabletop lateral V1 [PWM%]	150	80
Tabletop lateral ACC V1 [s/10]	255	5
Tabletop lateral V2 [PWM%]	255	150
Tabletop lateral ACC V2 [s/10]	255	20
Tabletop lateral DEC [s/10]	255	100
Tabletop lateral DNS	255	20
Cassette MAX	1023	989
Cassette MIN	1023	65
Cassette V1 [Hz]	255	20
Cassette V2 [Hz]	255	70
Cassette ACC V1 [s/10]	255	3
Cassette DEC [s/10]	255	3
Cassette DNS	255	130
Cassette V X-ray [Hz]	25	13
******** Center stop ********	0	0
Tilt stop at level point yes/no [1/0]	1	1
System center stop yes/no [1/0]	1	0
Tabletop long. center stop yes/no [1/0]	1	0
Tabletop lateral center stop yes/no [1/0]	1	1
***** Axis Positionmemory *****	0	0

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Contents   Installation   Service   Schematics   Periodic Maintenance   Illustrated Parts

System store yes/no [1/0]	1	1
Tabletop long. store yes/no [1/0]	1	1
Tabletop lateral store yes/no [1/0]	1	1
Tilt store yes/no [1/0]	1	0
Vertical store yes/no [1/0]	1	0
******** Loadposition ********	0	0
Load position Tilt/Vertical M1	1023	206
Load position System	1023	337
Load position Tilt/Vertical M3	1023	393
Load position Tabletop long.	1023	507
Load position Tabletop lateral	1023	871
***** Image Intensifier *****	0	0
Film cassette Detector/yes/no [2/1/0]	1	0
II Magnification [1..4]	4	3
II depth [mm]	1000	607
II width-foot [mm]	1000	100
II width-head [mm]	1000	100
Distance II-center - footend [mm]	1023	233
***** Table configuration *****	0	0
Slow motion [s/10]	255	20
Isocentric yes/no [1/0]	1	0
V1 isocentric [Hz]	255	25
V2 isocentric [Hz]	255	60
Uro-type right/left [1/0]	1	1

Tableextension [mm]	1000	784
Micturitionseat [mm]	1000	190
Ellbowrests [mm]	1000	400
Saftydistance first [mm]	1000	68
Saftydistance end [mm]	1000	50
Light time [s]	60	30

#506=1

#507= 002

#508=1

#509=47

#510= 70

Contents   Installation   Service   Schematics   Periodic Maintenance   Illustrated Parts

Configuration File Example

The following is an example of the configuration file. Do not use these numbers for the Max/Min/Byte values as the actual values could be different. Refer to the *Table Configuration* chart above, however, the format below is correct for the file.

Name	Min	Max	Wert	Byte
Tilt MAX	0	1023	361	2
Tilt MIN	0	1023	376	2
Tilt Null-Grad	0	1023	186	2
Tilt V1 [Hz]	0	100	60	1
Tilt ACC V1 [s/10]	0	255	7	1
Tilt V2 [Hz]	0	100	90	1
Tilt ACC V2 [s/10]	0	255	14	1
Tilt DEC [s/10]	0	255	4	1
Tilt DNS	0	255	5	1
Vertical MAX	0	1023	776	2
Vertical MIN	0	1023	302	2
Vertical V1 [Hz]	0	40	35	1
Vertical ACC V1 [s/10]	0	255	7	1
Vertical V2 [Hz]	0	70	63	1
Vertical ACC V2 [s/10]	0	255	14	1
Vertical DEC [s/10]	0	255	4	1
Vertical DNS	0	255	5	1
System MAX	0	1023	675	2
System MIN	0	1023	349	2
System X-ray position	0	1023	489	2
System V1 [Hz]	0	40	40	1
System ACC V1 [s/10]	0	255	7	1
System V2 [Hz]	0	70	40	1
System ACC V2 [s/10]	0	255	14	1

Diagnostics

Name	Min	Max	Wert	Byte
System DEC [s/10]	0	255	3	1
System DNS	0	255	20	1
Tabletop long. MAX	0	1023	945	2
Tabletop long. MIN	0	1023	68	2
Tabletop long. NULL	0	1023	505	2
Tabletop long. V1 [Hz]	0	40	30	1
Tabletop long. ACC V1 [s/10]	0	255	7	1
Tabletop long. V2 [Hz]	0	70	60	1
Tabletop long. ACC V2 [s/10]	0	255	14	1
Tabletop long. DEC [s/10]	0	255	3	1
Tabletop long. DNS	0	255	5	1
Tabletop lateral MAX	0	1023	861	2
Tabletop lateral MIN	0	1023	140	2
Tabletop lateral NULL	0	1023	500	2
Tabletop lateral V1 [PWM%]	0	150	80	1
Tabletop lateral ACC V1 [s/10]	0	255	5	1
Tabletop lateral V2 [PWM%]	0	255	150	1
Tabletop lateral ACC V2 [s/10]	0	255	20	1
Tabletop lateral DEC [s/10]	0	255	100	1
Tabletop lateral DNS	0	255	20	1
Cassette MAX	0	1023	986	2
Cassette MIN	0	1023	62	2
Cassette V1 [Hz]	0	255	20	1
Cassette V2 [Hz]	0	255	70	1
Cassette ACC V1 [s/10]	0	255	3	1
Cassette DEC [s/10]	0	255	3	1
Cassette DNS	0	255	130	1
Cassette V X-ray [Hz]	0	25	12	1

Contents   Installation   Service   Schematics   Periodic Maintenance   Illustrated Parts

Name	Min	Max	Wert	Byte
******** Center stop ********	0	0	0	1
Tilt stop at level point yes/no [1/0]	0	1	1	1
System center stop yes/no [1/0]	0	1	0	1
Tabletop long. center stop yes/no [1/0]	0	1	0	1
Tabletop lateral center stop yes/no [1/0]	0	1	1	1
***** Axis Positionmemory *****	0	0	0	1
Vertical store yes/no [1/0]	0	1	1	1
Tilt store yes/no [1/0]	0	1	1	1
System store yes/no [1/0]	0	1	1	1
Tabletop long. Store yes/no [1/0]	0	1	0	1
Tabletop lateral store yes/no [1/0]	0	1	0	1
******** Loadposition ********	0	0	0	1
Load position Tilt/Vertical M1	0	1023	206	2
Load position System	0	1023	337	2
Load position Tilt/Vertical M3	0	1023	393	2
Load position Tabletop long.	0	1023	507	2
Load position Tabletop lateral	0	1023	871	2
***** Image Intensifier *****	0	0	0	1
Film cassette Detector/yes/no [2/1/0]	0	1	1	1
II Magnification [1..4]	1	4	3	1
II depth [mm]	0	1000	607	2
II width-foot [mm]	0	1000	100	2
II width-head [mm]	0	1000	100	2
Distance II-center - footend	0	1023	233	2

Diagnostics

Name [mm]	Min	Max	Wert	Byte
***** Table configuration *****	0	0	0	1
Slow motion [s/10]	0	255	20	1
Isocentric yes/no [1/0]	0	1	1	1
V1 isocentric [Hz]	0	255	25	1
V2 isocentric [Hz]	0	255	60	1
Uro-type right/left [1/0]	0	1	0	1
Tableextension [mm]	0	1000	775	2
Micturitionseat [mm]	0	1000	350	2
Ellbowrests [mm]	0	1000	492	2
Saftydistance first [mm]	0	1000	68	2
Saftydistance end [mm]	0	1000	50	2
Light time [s]	0	60	25	1

Log Access

The Utility Suite software gives the user the capability to retrieve/save/open/print three different types of system logs: The System Events Log, the Generator Tracking and Trending (TNT) Log, and the Generator Events Log.

To access a log file, plug a laptop computer into the 15-pin P4 connector on the rear panel of the workstation. Using the *Utilities Suite* software, access the **RUT Views (2800)** section and click on EVENT LOGS to see the screen below.

The type of log is selected using the tabs at the bottom of the log window as shown below. Click on the GET LOG FILE button to retrieve the desired log. The log entries are displayed in the central window and can be sorted in order of Date and Time, Type or Message by clicking on the heading above the desired field of the entries.
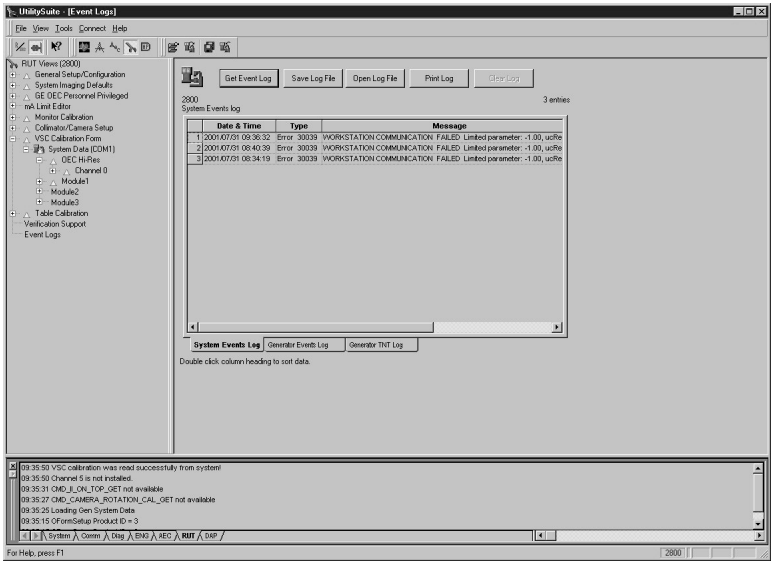
System Events Log

The System Events Log stores details of system operation with the date and time, along with parameters and units of measure (if applicable). Clicking on the "Events Log" button accesses this log.

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Diagnostics

System Events Log Reporting

The OEC UroView® System Events Log obtains an error message from the Generator and adds the following information:

1. System time: date and time when the error occurred. The system time is different than the Generator time

2. System Phase. State of the system where the error occurred.

3. Error message (refer to the *Alphabetical VFD Message listings* in this manual section).

Whenever a generator error is logged in the System Events Log file and displayed on the operator console (or workstation), the generator events log upload functionality is available for more detailed error information. This function must be performed from the operator console (or workstation) or by uploading the file into a laptop and opening it with UtilitySuite.

Having this information, look at the generator trouble-shooting table to find the FRU to replace.

The system logs errors and uses them to determine the next acquisition mode (degraded or not). The generator error log file contains a maximum of 64 log entries.

Diagnostics

Each error log entry has the following structure:

Date & time	Component/System Section	Error Message	Number of Occurrences	Units

System Events Log Sample

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Contents   Installation   Service   Schematics   Periodic Maintenance   Illustrated Parts

Generator Tracking and Trending (TNT) Log

The Generator Tracking and Trending Log (TNT) collects data from the system on general operations.

Generator Tracking and Trending (TNT) Log Sample

Generator TNT Event Log

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Contents   Installation   Service   Schematics   Periodic Maintenance   Illustrated Parts

Diagnostics
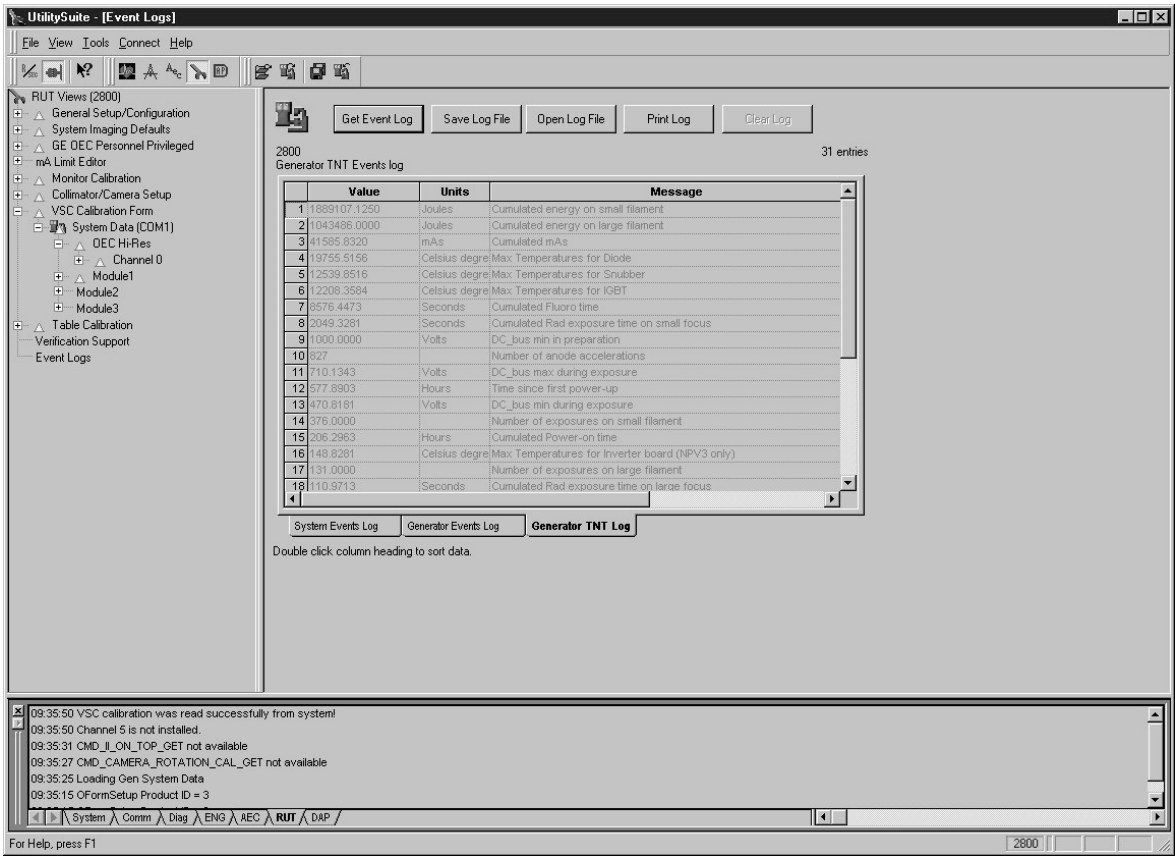
Generator Events Log

The Generator Events Log is a file that is written to after each event or error displayed on the VFD. The log file is accessed by connection of a laptop computer to the system. The Utility Suite program is used to download and view the log for troubleshooting purposes.

Entries in the log are given type numbers by the Utility Suite software, plus the date, time and message is recorded.

A sample enlarged Generator Events Log window is shown below:
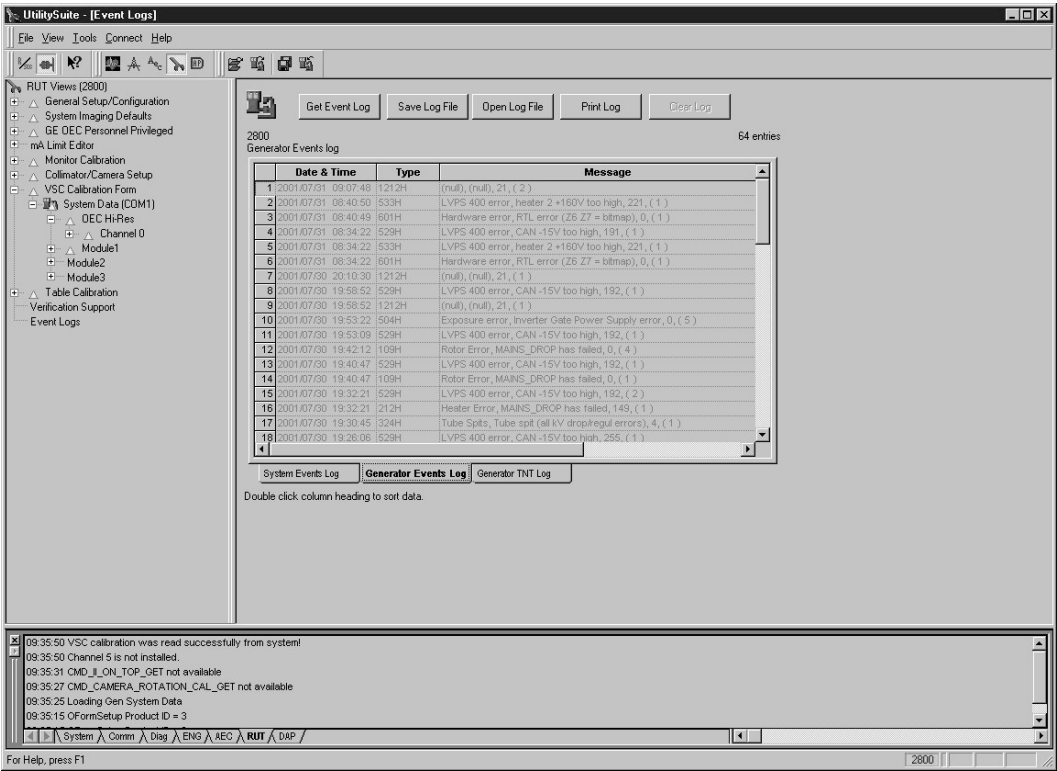
Generator Events Log Sample

Generator Errors

Power-on Diagnostics

At power up, the kV Control PCB performs its own initialization, checks its memory integrity and starts the communication with its peripherals and the system; Communication is permanently checked afterwards. Then it initializes the Rotation PCB and Heater PCB with their respective database parameters and loads kV Control FPGA.

Eight LEDs (S7 - S0) on the kV Control PCB show the software status. (Refer to the *Reading kV Control PCB Power-on Diagnostic LEDs* in this manual section.*)*

During power on, the Heater PCB and the Rotation PCB CPU's initialize themselves and check their memory integrity and hardware. If a problem is encountered, an error is reported to the kV Control PCB.

Live Diagnostics

Diagnostic faults are reported using an error code and associated message to the error log. Some are straight forward and others must be researched to find their root cause. Refer to the listing in the *Alphabetic VFD Message Listing* inthis manual section for causes and recommended action.

Diagnostics run separately:

1) Heating without HV nor rotation

2) Rotation without HV nor filament

3) Inverter gate command diagnostic

4) Inverter in Short circuit diagnostic

5) No load HV without anode rotation nor filament heating

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Contents   Installation   Service   Schematics   Periodic Maintenance   Illustrated Parts

The Generator performs self-calibrations initiated by commands via the CAN Bus serial port. Various data is downloaded into the Generator including, but not limited to, AEC tables, X-ray Tube data, etc.

When an error is detected, it is sent to the system and is logged in parallel in the generator error log file.

The following is a general list of generator errors and their error codes. As a troubleshooting aid, a detailed listing follows this table with troubleshooting suggestions for many of the error codes.

Heating without HV nor Rotation Diagnostic

Purpose :

The purpose of this test is to drive the heater inverter(s) on both filaments and all the tubes connected to the Generator in order to identify a faulty heater FRU or a wrong connection between heater board, HV Tank and tube(s).

Pre-requisites :

- PPC kV control board alive and running : S0-S7 Leds are lit successively or a combination of them blink
- heater board alive and running : DS1 and DS2 Leds are lit successively
- heater DC supply present : DS3 Led is lit

Test type : No manual interaction with the use of the Diagnostic screen on system console

Sequence :

Once selected the tube the test is running on , start the diagnostic.

The following sequence runs on the small focus and then on the large focus :

    - 5 seconds preheat
    - 0,4s boost
    - 5s heat (focal spot max current - 1Amp)

There is 10s stop time between each focal spot run.

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During the test , the heater safeties are checked the same way than in application mode.

Error codes reporting :

If test fails, generator goes onto error state with associated error code. Refer to the troubleshooting table

Rotation without HV nor Filament Diagnostic

Purpose :

The purpose of this test is to drive the rotation inverter(s) in high speed mode (for application supporting high speed mode) and low speed mode on all the tubes connected to the Generator in order to identify a faulty rotation FRU or a faulty dephasing capacitors FRU or a wrong connection between rotation board, HEMIT (only for NP++) and tube.

Pre-requisites:

- PPC kV control PCB alive and running : S0-S7 LEDs are lit successively or a combination of them blink
- rotation board alive and running : DS5 Led blinking
- rotation DC supply present : DS7 neon is lit
- cabling between rotation board and tube checked (including HEMIT connections for NP++ only)

Test type: No manual operation on the generator is required for the test

Sequence:

Once selected, the tube the test is running on, start the diagnostic.

The following sequence runs in low speed mode and then in high speed mode (if high speed mode allowed):

 - acceleration (time depends on tube type)

- 2s run
- brake (time depends on tube type)

There is 2s stop time between each speed mode.

During the test , the rotation safeties are checked the same way than in application mode.

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Error codes reporting :

If test fails, generator goes onto error state with associated error code. Refer to the troubleshooting table.

Inverter Gate Command Diagnostic

Purpose :

The purpose of this test is to verify that the HV power inverter drive is working properly. The IGBTs gate drive supply and the IGBTs gate drive is verified. At the same time verification is made that no inverter currents nor high voltage are measured. This test is performed without DC voltage applied to the inverter so that no Xray is generated. Anode rotation and filament drive are not activated during this test.

Pre-requisites :

- Generator input line in an acceptable range (380V-10% to 480V+10% for 3-phase AC input)

- PPC kV control board alive and running : S0-S7 Leds are lit successively or a combination of them blink
- Inverter gate_cmd board DC supply present : DS300 neon is lit

Test type : Manual operation is required.

Sequence :

1. Disconnect the 2 DC bus cables between AC/DC board and Resonant Circuit Power Components in Inverter (see block diagrams).

2. Power on the Generator

3. Verify that the DS1-DS2 leds on inverter quad snubber board are not lit

4. Start the diagnostic and verify :

- error reported on the operator console
- inverter gate_cmd board LEDs DS101, DS 102, DS201, DS202 are lit : IGBTs gate drive supply is working properly

5. Press the exposure switch

6. During the "exposure", verify :

- error reported on the operator console
- inverter gate_cmd board Leds DS100 and DS200 are lit : IGBTs gate drive is working properly

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7. Release the exposure switch

8. Power off the Generator . Wait until residual voltage disappears .

9. Reconnect the 2 DC bus cables

Error reporting :

If test fails, generator goes onto error state with associated error code. Refer to the troubleshooting table

error	Conclusion
DS1-DS2 lit	Check that DC bus cables have been removed
DS300 neon off	Check the gate_cmd supply cable between AC/DC and gate_cmd board
0309/ 0310/ 0311/ 0312/ 0313/ 0314/ 0319/ 0323/ 0324 (hex)	Check that DC bus cables have been removed. If yes, replace PPC kV control board
0320h	if problem persists, replace PPC kV control board
0501h	PPC kV control board or inverter fault, replace PPC kV control board first
0503h 0504h	PPC kV control board or inverter fault, replace PPC kV control board first
DS101/DS102/DS201/DS202 One led off while no error reported	Replace inverter
DS100 and/or DS200 Leds off	Check cabling between PPC kV control, HV Tank and gate_cmd board. If cabling is right, PPC kV control board or inverter fault, replace PPC kV control board first

Inverter in Short Circuit Diagnostic

Purpose :

The purpose of this test is to verify that the HV power inverter is working properly. The inverter is commanded at a fixed frequency and is loaded with a short circuit. Verification is made that the inverter currents are correctly set. At the same time verification is made that no High voltage is measured. This test is performed without connecting the HV Tank to the inverter so that no Xray is generated. Anode rotation and filament drive are not activated during this test.

Pre-requisites :

- Generator input line in an acceptable range (380V-10% to 480V+10% for 3-phase AC input)

- PPC kV control board alive and running : S0-S7 Leds are lit successively or a combination of them blink
- inverter gate_cmd board DC supply present : DS300 neon is lit
- inverter quad snubber board DC supply present : DS1-DS2 led are lit
- Inverter gate command diagnostic passed without failure

Test type : Manual operation is required.

Sequence :

1. Disconnect the HV Tank primary cables from the inverter (see HV Tank replacement job card).

Take care not to disconnect at the same time the plate cable connected to the quad snubber board which is tightened with the HV Tank primary cables.

2. Install the short circuit cable included in the first aid kit as shown in the picture on the following page (the cable in red).

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Diagnostics

Short Circuit
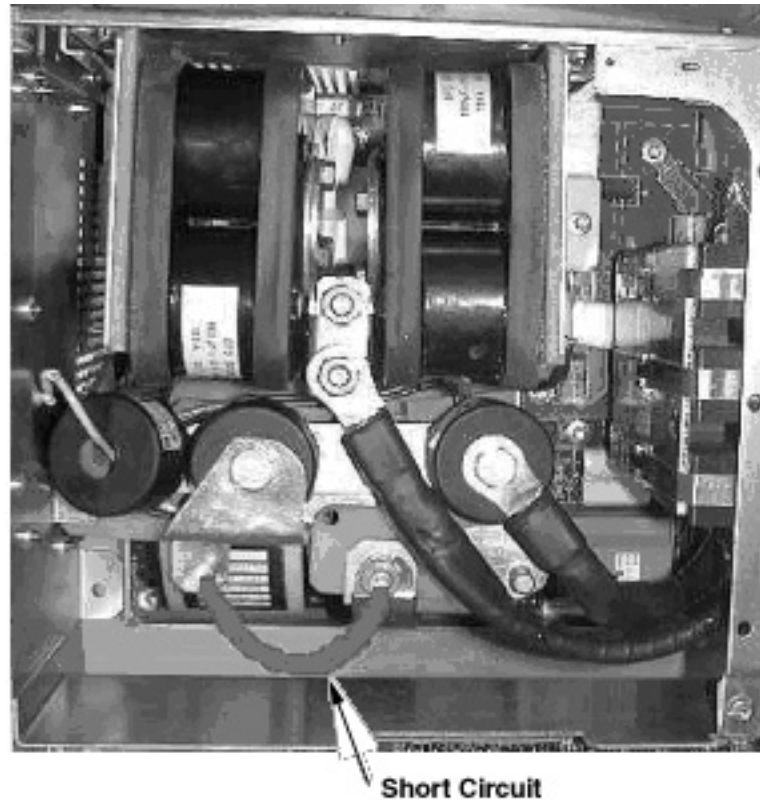
Inverter Configuration

3. The parallel inductor and serial inductor must be connected

4. Power on the Generator

5. Verify that the DS1-DS2 leds on inverter quad snubbers board is lit

6. Verify that the DS300 neon on inverter gate_cmd board is lit

7. Start the diagnostic and verify that no error is reported on the operator console

8. Press the exposure switch (500ms exposure is taken)

9. Release the exposure switch

10. Verify error reported on the console

11. After exiting the test, power off the Generator

12. Remove the short circuit cable, reconnect the HV Tank primary cables (see HV Tank replacement job card).

Error reporting :

If test fails, generator goes onto error state with associated error code. Refer to the troubleshooting table

error	Conclusion
DS1-DS2 leds off	Check that DC bus cables between AC/DC and inverter
DS300 neon off	Check the gate_cmd supply cable between AC/DC and gate_cmd PCB
0309/ 0310/ 0319/ 0324 (hex)	Check that HV Tank primary cables have been removed. If yes, replace PPC kV control PCB
0311/ 0312/ 0313/ 0314/ 0320/ 0323 (hex)	Replace Inverter or PPC kV control PCB
0501/ 0503/ 0504/ 0505 (hex)	Replace Inverter or PPC kV control PCB

Note 1:   Ilp and Ilr currents not detected

1. Check the -15V (Led DS1) on PPC kV control board (see block diagram).

If it is not lit, refer to "other failures" section. Else :

2. Power off the Generator. Wait until all neons are off

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Diagnostics

3. Check that the currents transformers (capacitor set) to gate_cmd board cable is correctly connected. If yes :

4. Check that the inverter inductors are correctly connected. If yes :

5. Check that HV Tank is correctly connected to the capacitors set. If yes :

6. Check that the gate_cmd to HV Tank cable and HV Tank to PPC kV control cables are correctly connected.

If yes, replace the inverter.

7. Reconnect all the cables

Note 2 :   Ilp current not detected

1. Power off the Generator. Wait until all neons are off

2. Check that the parallel inductor is correctly connected. If yes:

3. Check that the parallel inductor impedance is 0 Ohms. If no : replace inverter. If yes :

4. Check that inverter capacitors (capacitors set) are not broken. If yes, replace the capacitor set. Else:

5. Disconnect the currents transformers to gate_cmd board cable. Check that the parallel current transformer impedance is 0. If no: replace the capacitor set. Else:

6. Check that the gate_cmd to HV Tank cable and HV Tank to PPC kV control cables are correctly connected. If yes:

7. Disconnect the HV Tank to PPC kV control cable. Check that the impedance between pin20 and pin21 of J2 of HV Tank is 3.3 Ohms. If no replace the inverter. If yes: replace PPC kV control PCB.

8. Reconnect all the cables

Note 3 :   Ilr current not detected

1. Power off the Generator. Wait until all neons are off

2. Check that the inductors are correctly connected. If yes :

Note 4:   Ilr current resonant frequency is lower than expected.

1. Power off the Generator. Wait until all neons are off

2. Check that the inductors are correctly connected. If yes:

3. Check that inverter capacitors (capacitors set) are not broken. If yes: replace the capacitor set. Else:

4. Disconnect the currents transformers to gate_cmd board cable. Check that the parallel current transformer impedance is 0. If no: replace the capacitor set. Else: replace PPC kV control PCB.

4.   Reconnect all the cables.

No Load HV Diagnostic without Anode Rotation or Filament Heating

Purpose :

The purpose of this test is to verify that the HV power inverter and HV tank are working properly. The exposure is taken as in application mode except that no filament drive is applied and anode rotation is running. Verification is made that the inverter currents are correctly set and that kV regulation is operating properly. As no filament drive is applied, no x-rays are generated.

This test also allows to separate generator from HV cable or x-ray tube problem by running it with or without HV cables plugged on the HV tank (see Warning).

Pre-requisites :
- Generator input line in an acceptable range (380V-10% to 480V+10% for 3-phase AC input)

- PPC kV control PCB alive and running: S0-S7 LEDs are lit successively or a combination of them blink
- inverter gate_cmd PCB DC supply present: DS300 neon is lit
- inverter quad snubber PCB DC supply present: DS1-DS2 LEDs are lit
- Inverter gate command diagnostic passed without failure
- Inverter in short circuit diagnostic passed without failure

Warning!
HV receptacles must be filled with oil if HV cables are removed.

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Test type: Manual operation is required.

Sequence :

1. Power on the Generator

2. Start the diagnostic and verify:

- error reported on the operator console
- inverter gate_cmd PCB LEDs DS101, DS 102, DS201, DS202 are lit: IGBTs gate drive supply is working properly

3. Select kV (Default = 80 kV) and exposure time (Default = 1 sec.)

4. Press the exposure switch

5. During the exposure, verify any error reported on the operator console

6. Release the exposure switch

7. Power off the Generator

Error reporting :

If test fails, generator goes onto error state with associated error code. Refer to the troubleshooting table

AEC Diagnostic

Purpose:
The purpose of this test is to drive the AEC function to identify a faulty AEC, IF or PPC kV control PCB FRU or the wrong connection between the AEC PCB and ion chambers.

Pre-requisites:
• application mode without AEC mode is running properly
• PPC kV control PCB alive and running: S0-S7 LEDs are lit successively or a combination of them blink

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- cabling between IF PCB, AEC PCB and ionization chambers checked.

Test type: Manual operation is required.

Sequence:
Select AEC function in Generator Diagnostic screen
Press Start to run the test.
AEC function is verified through a series of 7 tests as follows:
- AEC return measurement test:
A voltage reference is switched to one input of the AEC select multiplex.
Nominal value of return voltage = 5.24 V
Test 1 is OK if: 4 V < measured value < 6 V
This test is also performed at lower frequency count up:
Test 2 is OK if: 4 V < measured value < 6 V.
- Switching Gain test (x10):
A voltage reference is switched to one input of the AEC select multiplex and count up gain is applied.
Nominal value of return voltage = 4.76 V
Test 3 is OK if: 4 V < measured value < 6 V.
- AEC ion chamber HV power supply test:
A portion of HV power supply is switched to one input of the AEC select multiplex:
- No cell selected, Test 4 is OK if return voltage measurement is 0 V.
- Select respectively one of the three cells, left, right, middle.
Test 5, 6, 7 are OK if: 1 V < measured value < 3 V.

Error codes reporting:
If test fails, generator goes onto error state with associated error code. Refer to the troubleshooting table.

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Other Generator Failures

The following pages contain a troubleshooting chart for generator Communication problems, i.e., the generator does not answer to system messages, plus a chart for determining if fuses are blown or main breakers are tripped.

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No answer from JEDI

DS8 in LVPS400 ON? — No → No 115V/220V supply to LVPS400. Check supply from system

Yes ↓

DS6 & DS7 in LVPS400 ON? — No → Overload of +/-15V CAN

Yes ↓

DS4 & DS6 in PPCKVCTRL ON? — No → No +/-15V supply to PPCKVCTRL. Check connection of flat cable between LVPS400 and PPCKVCTRL

Yes ↓

DS2, 3, 5 & 7 in PPCKVCTRL ON? — No → Defective PPCKVCTRL internal power supplies. Replace board

Yes ↓

DS19 to 26 in PPCKVCTRL blinking ? — Yes → DS1 in GEN_IF blinking when system sending CAN messages to JEDI? — Yes → Defective PPCKVCTRL Replace board

DS1 in GEN_IF blinking when system sending CAN messages to JEDI? — No ↓

DS1 in GEN_IF always ON? — Yes → Defective GEN_IF Replace board

DS1 in GEN_IF always ON? — No ↓

JEDI not receiving CAN messages. Check cable and system CAN interface

DS19 to 26 ... — No ↓

Overload of +/-15V CAN ↓

Power off
Disconnect flat cable on J5 in AEC board
Power on ↓

DS6 & DS7 in LVPS400 ON? — Yes → Power off
Re-connect AEC
Disconnect J1 & J2 DB9 connectors from ion chamber in AEC board
Power on ↓

DS6 & DS7 in LVPS400 ON? — No ↓

Power off
Re-connect AEC
Disconnect flat cable on J1 in Rotation board
Power on ↓

DS6 & DS7 in LVPS400 ON? — No ↓ / Yes → Defective Rotation board. Replace board

DS6 & DS7 in LVPS400 ON? (AEC branch) — Yes → Defective Ion chamber Check cables or change Ion chamber

DS6 & DS7 in LVPS400 ON? (AEC branch) — No → Defective AEC board. Replace board

Power off
Re-connect Rotation
Disconnect flat cable on J1 in Heater board
Power on

Repeat this step for each heater board

DS6 & DS7 in LVPS400 ON? — Yes → Defective Heater board. Replace board

DS6 & DS7 in LVPS400 ON? — No ↓

Continued on following page…

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Diagnostics

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DS22 & DS24 in PPCKVCTRL blinking?

Yes → Check 12V or 15V supply from system on interface cable. Check on capa C33 or pin 1 & 9 of J4 subD connector or pin 1 & 2 J5 HE10 connector in GEN_IF board

12V or 15V OK?

Yes → Defective GEN_IF Replace board

No → No 12V or 15V supply to GEN_IF. Check cable and supply from system.

No

DS23 to 26 in PPCKVCTRL ON?

Yes → JEDI software corrupted. Try to download boot & appli. If not successful, replace PPCKVCTRL board

No → DS19 to 26 OFF PPCKVCTRL hang up. Reset JEDI several times. If problem persists, replace board

No → Power off Re-connect Heater Disconnect flat cable on J2 in PPCKVCTRL board Power on

DS6 & DS7 in LVPS400 ON?

Yes → Power off Re-connect PPCKVCTRL Disconnect flat 64-pin cabel between GEN_IF and PPCKVCTL boards Power on

No → Power off Re-connect PPCKVCTRL Disconnect flat cables on J3 & J6 in LVPS400 board Power on

DS6 & DS7 in LVPS400 ON?

Yes → Defective flat cables. Check and replace cables

No → Defective LVPS400 board. Replace board

DS6 & DS7 in LVPS400 ON?

Yes → Defective GEN_IF board Replace board

No → Power off Re-connect 64-pin cable Disconnect flat 50-pin cabel between KV_MEAS and PPCKVCTL boards Power on

DS6 & DS7 in LVPS400 ON?

Yes → Defective of GATE_CMD board. Replace Inverter

No → Defective PPCKVCTRL board. Replace board

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This troubleshooting chart assumes a 3-phase breaker could be tripped in PDU/PDB or the main fuses might be blown:

```
                    ┌──────────────────────┐
                    │  3 phase input to JEDI│
                    │  breaker tripped or   │
                    │  fuses blow n         │
                    └──────────┬───────────┘
                               │
                               ▼
                    ╱──────────────────────╲
                   │ Disconnect DCBUS cables betw een
                   │ ACDC module and inverters module.
                   │ Measure impedance at Inverter's
                   │ DCBUS input
                    ╲──────────────────────╱
                               │
                               ▼
                         ◇ Short circuit? ◇ ──Yes──►  ┌────────────────────┐
                               │                       │ IGBT in short circuit in
                               │                       │ Inverter.
                              No                       │ Replace inverter module
                               │                       └────────────────────┘
                               ▼
                    ╱──────────────────────╲
                   │ Disconnect EMC board from ACDC
                   │ diode bridge. Measure impedance
                   │ impedance betw een EMC input
                   │ phases and to the ground
                    ╲──────────────────────╱
                               │
                               ▼
                         ◇ Short circuit? ◇ ──Yes──►  ┌────────────────────┐
                               │                       │ EMC board in short circuit.
                              No                       │ Replace EMC board
                               │                       └────────────────────┘
                               ▼
                    ┌──────────────────────┐
                    │ Diode bridge or ACDC board in
                    │ shortcircuit.
                    │ Replace diode bridge and ACDC
                    │ board
                    └──────────────────────┘
```

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Diagnostics

Generator Error Messages

Error Code Hex --- Dec.		Error Code	Description
101	257	Rotor Error	No CAN message received within 5 sec
102	258	Rotor Error	Database not correct
103	259	Rotor Error	Current overload
104	260	Rotor Error	Openload
105	261	Rotor Error	Phases unbalanced
106	262	Rotor Error	Phases error
107	263	Rotor Error	Inverter permanent overcurrent
108	264	Rotor Error	Command error
109	265	Rotor Error	MAINS_DROP has failed
110	272	Rotor Error	PRD error (Z3 Z4 = bitmap)
111	273	Rotor Error	F0 main frequency problem
111	273	Thermal error	Rotor Thermal error
112	274	Rotor Error	HW/FW config error
113	275	Rotor Error	IUVW short circuit error
114	276	Rotor Error	HV cable short circuit error
115	277	Rotor Error	HV cable open error
149	329	Rotor Error	Unknown error
151	337	Rotation Warning	CAN Domain command number error
152	338	Rotation Warning	CAN Domain request with no transfer init
153	339	Rotation Warning	CAN Domain Toggle bit error
154	340	Rotation Warning	CAN Domain : less than 2 data to download

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Error Code Hex --- Dec.		Error Code	Description
155	341	Rotation Warning	CAN Domain Abort received & applied
156	342	Rotation Warning	Bad index in config upload
157	343	Rotation Warning	Tube switch while rotor not off
158	344	Rotation Warning	Acceleration cmd while no tube selected
159	345	Rotation Warning	Acceleration cmd while database not OK
160	352	Rotation Warning	Database download while rotor speeding
161	353	Rotation Warning	Acceleration command not OK
162	354	Rotation Warning	Acceleration while in error
162	354	Rotor Error	Acceleration while in error
163	355	Rotation Warning	No CAN message received within 4 sec
163	355	Rotor Error	No CAN message received within 4 sec
164	356	Rotation Warning	Inverter overcurrent (< 3 times)
180	384	Hardware error	Rotor board com pb
181	385	Hardware error	Rotor board has reset
199	409	Rotation Warning	Unknown warning
201	513	Heater Error	Heater 0: no CAN message received within 5 secs
202	514	Heater Error	Heater 0: database not correct
203	515	Heater Error	Heater 0: inverter permanent overcurrent
204	516	Heater Error	Heater 0: filament permanent open circuit
205	517	Heater Error	Heater 0: inverter permanent short circuit
206	518	Heater Error	Heater 0: filament Overload Pre-heat

Error Code Hex --- Dec.		Error Code	Description
207	519	Heater Error	Heater 0: filament Overload Boost
208	520	Heater Error	Heater 0: filament Overload Heat
209	521	Heater Error	Heater 0: command error
210	528	Heater Error	Heater 0: PWM rate too low
211	529	Heater Error	Heater 0: PWM rate too high
212	530	Heater Error	Heater 0: MAINS_DROP has failed
213	531	Heater Error	Heater 0: PRD error (Z3 Z4 = bitmap)
214	532	Heater Error	Heater 0: boost too long
215	533	Heater Error	Heater 0: filament selection error
216	534	Heater Error	Heater 0: current feedback not nul when inverter off
221	545	Heater Error	Heater 0: filaments database tube1 err (Z3= LF Z4=SF)
222	546	Heater Error	Heater 0: filaments database tube2 err (Z3= LF Z4=SF)
223	547	Heater Error	Heater 0: filaments database tube3 err (Z3= LF Z4=SF)
224	548	Heater Error	Heater 0: filaments database tube4 err (Z3= LF Z4=SF)
248	584	Heater Error	Heater large focus error
249	585	Heater Error	Heater small focus error
251	593	Heater Warning	Heater 0: received command is not OK
252	594	Heater Warning	Heater 0: command not OK
254	596	Heater Warning	Heater 0: inverter overcurrent (inverter1) (<3 times)
255	597	Heater Warning	Heater 0: filament open circuit (inverter1) (<3 times)
256	598	Heater Warning	Heater 0: inverter short circuit (inverter1) (<3times)
257	599	Heater Warning	Heater 0: tube switch while filaments not OFF

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Error Code Hex --- Dec.		Error Code	Description
258	600	Heater Warning	Heater 0: CAN Domain command number error
259	601	Heater Warning	Heater 0: CAN Domain request with no transfer init
260	608	Heater Warning	Heater 0: CAN Domain Toggle bit error
261	609	Heater Warning	Heater 0: CAN Domain less than 2 data to download
280	640	Hardware error	Heater 0 board com pb
281	641	Hardware error	Heater 0 board has reset
299	665	Heater Warning	Heater 0: unknown warning
301	769	Tube Spits	Tube spit (kV+ and kV- dropped)
302	770	Tube Spits	Tube spit (kV+ has dropped)
303	771	Tube Spits	Tube spit (kV- has dropped)
304	772	Tube Spits	Tube spit (kV regulation error)
305	773	Tube Spits	FPGA problem (restarting safety signal)
306	774	Exposure error	No kV Feedback on anode
307	775	Exposure error	No kV Feeback on cathode
308	776	Exposure error	No kV Feedback on anode and cathode
309	777	Exposure error	kV detected during kV diag
310	784	Exposure error	kV max detected
311	785	Exposure error	ILP current not OK
312	786	Exposure error	ILR current not OK
313	787	Exposure error	ILR max current detected
314	788	Exposure error	ILR current timeout
316	790	Exposure error	Spit Max error

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Error Code Hex --- Dec.		Error Code	Description
317	791	Exposure error	Spit Ratio error
318	792	Exposure error	kV did not reach 75%(rad) or 95%(gridded) after 20ms
319	793	Exposure error	kV unbalanced detected
320	800	Exposure error	FPGA problem (safety signal)
321	801	Exposure error	Spit retry failed (TD computing)
322	802	Hardware error	kV ref ADC / DAC failled
323	803	Exposure error	ILR and ILP current not OK
324	804	Tube Spits	Tube spit (all kV drop/regul errors)
325	805	Exposure error	DSP overload
326	806	Exposure error	DSP exposure stop
327	807	Exposure error	DSP regul. out of range
328	808	Tube Spits	Warning
329	809	Exposure error	wrong HV capa measure
350	848	Exposure error	TMax 10s Overflow
351	849	Exposure error	Repetitive Error
3A0	928	Hardware error	DSP error
401	1025	Exposure error	No mA feedback
402	1026	Exposure error	mA scale error
403	1027	Exposure error	mA out of range
404	1028	Application warning	No Pulse Warning
450	1104	Tube Spits	Tube Curr max detected
451	1105	Exposure error	mA meter saturated

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Error Code Hex --- Dec.		Error Code	Description
501	1281	Power Supply errors	DC bus out of range
502	1282	Power Supply errors	Error Overvoltage > 780 VDC
503	1283	Power Supply errors	Inverter Gate Power Supply error
504	1284	Exposure error	Inverter Gate Power Supply error
505	1285	Power Supply errors	Mains power supply has dropped during exposure
506	1286	Power Supply errors	DC bus 1 phase precharge error
507	1287	Power Supply errors	DC bus 1 phase discharge error
508	1288	LVPS Warning	Warning Overvoltage > 755VDC
509	1289	LVPS Warning	Warning Undervoltage < 320VDC
510	1296	Power Supply errors	HVPM AEC not 230V
520	1312	LVPS Warning	LVPS 400: received command is not OK
521	1313	LVPS Warning	LVPS 400: external +15V too high
522	1314	LVPS Warning	LVPS 400: external +15V too low
523	1315	LVPS Warning	LVPS 400: external +160V too high
524	1316	LVPS Warning	LVPS 400: external +160V too low
525	1317	LVPS Warning	LVPS 400: gate +24V too high
526	1318	LVPS Warning	LVPS 400: gate +24V too low
527	1319	LVPS Warning	LVPS 400: CAN +15V too high
528	1320	LVPS Warning	LVPS 400: CAN +15V too low
529	1321	LVPS Warning	LVPS 400: CAN -15V too high
530	1328	LVPS Warning	LVPS 400: CAN -15V too low
531	1329	LVPS Warning	LVPS 400: heater 0 +160V too high

Error Code Hex --- Dec.		Error Code	Description
532	1330	LVPS Warning	LVPS 400: heater 0 +160V too low
533	1331	LVPS Warning	LVPS 400: heater 1 +160V too high
534	1332	LVPS Warning	LVPS 400: heater 1 +160V too low
535	1333	LVPS Warning	LVPS 400: main inverter +17V too high
536	1334	LVPS Warning	LVPS 400: main inverter +17V too low
537	1335	LVPS Warning	LVPS 400: main inverter +26V too high
538	1336	LVPS Warning	LVPS 400: main inverter +26V too low
539	1337	LVPS Warning	LVPS 400: main inverter +160V too high
540	1344	LVPS Warning	LVPS 400: main inverter +160V too low
541	1345	LVPS Warning	LVPS 400: FAN 0 overcurrent
542	1346	LVPS Warning	LVPS 400: FAN 1 overcurrent
543	1347	LVPS Warning	LVPS 400: FAN 2 overcurrent
544	1348	LVPS Warning	LVPS 400: FAN 3 overcurrent
549	1353	Power Supply errors	LVPS TRI: unknown error
550	1360	LVPS Warning	LVPS TRI: no more warn +160V
551	1361	LVPS Warning	LVPS TRI: detected +160V too high
553	1363	Power Supply errors	LVPS TRI: detected +160V too high (Z6 Z7 = value)
555	1365	LVPS Warning	LVPS TRI: detected +160V too low
557	1367	Power Supply errors	LVPS TRI: detected +160V too low (Z6 Z7 = value)
560	1376	LVPS Warning	LVPS TRI: no more warn +15V
561	1377	LVPS Warning	LVPS TRI: detected +15V too high
563	1379	Power Supply errors	LVPS TRI: detected +15V too high (Z6 Z7 = value)

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Error Code Hex --- Dec.		Error Code	Description
565	1381	LVPS Warning	LVPS TRI: detected +15V too low
567	1383	Power Supply errors	LVPS TRI: detected +15V too low (Z6 Z7 = value)
570	1392	LVPS Warning	LVPS TRI: no more warn -15V
571	1393	LVPS Warning	LVPS TRI: detected -15V too strong
573	1395	Power Supply errors	LVPS TRI: detected -15V too strong
575	1397	LVPS Warning	LVPS TRI: detected -15V too weak
577	1399	Power Supply errors	LVPS TRI: detected -15V too weak
596	1430	LVPS Warning	LVPS 400: communication error
597	1431	LVPS Warning	LVPS 400: unknown error
599	1433	LVPS Warning	LVPS TRI: unknown warning
601	1537	Hardware error	RTL error (Z6 Z7 = bitmap)
602	1538	Hardware error	External CAN bus off
603	1539	Com errors	Debug screen com error
604	1540	Com errors	Database download error
605	1541	Com errors	TAV com error
606	1542	Com errors	MPC/Madrid com pb
607	1543	Com errors	room SLIO com problem !
650	1616	Com errors	ETHERNET com. error
651	1617	Com errors	HDLC com. error
652	1618	Com errors	APR com. error
701	1793	Application errors	Saved RAM checksum pb
702	1794	Application errors	Software problem

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Diagnostics

Error Code Hex --- Dec.		Error Code	Description
703	1795	Application warning	Watchdog reset has just occurred (MSB)
704	1796	Application errors	Heater / Rotor hold too long
705	1797	Application errors	Configuration error
706	1798	Application errors	Wrong DSP version
707	1799	Application errors	Wrong FPGA version
708	1800	Application warning	Watchdog reset has just occurred (LSB)
801	2049	Exposure error	Exposure backup mAs exceeded
802	2050	Exposure error	Exposure backup time exceeded
803	2051	Exposure error	Exp cmd while gene not ready
804	2052	Thermal error	Tank Thermal sensor to high
805	2053	Thermal error	Inverter HW Temperature too high
806	2054	Thermal error	Lp Temperature too high
902	2306	Hardware error	tube cooling supply error
903	2307	Thermal error	Tube exceeded 70degC
904	2308	Thermal error	HEMIT Error
905	2309	Thermal error	Tube thermal protection
1000	4096	Hardware error	Tube Switch com. Problem !
1001	4097	Application errors	Wrong tube number sel
1003	4099	Application errors	Tube Sel While Rotor On
1004	4100	Application errors	Tube Sel While Heat On
1005	4101	Application errors	Tube Sel While KV On
1006	4102	Hardware error	HV switch sel error

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Error Code Hex --- Dec.		Error Code	Description
1007	4103	Hardware error	Rotor switch sel error
1008	4104	Hardware error	Heater switch sel error
1010	4112	Hardware error	Tube Switch board has reset !
1011	4113	Application errors	Unexpected tube switch board
1012	4114	Application errors	Exposure preparation while tube not ready
1020	4128	Tube switch error	Tube switch status error !
1021	4129	Tube switch error	Tube switch state machine error
1022	4130	Tube switch error	Tube switch lamp relay feedback error
1023	4131	Tube switch error	Tube Switch heater SF feedback error
1024	4132	Tube switch error	Tube switch heater LF feedback error
1025	4133	Tube switch error	Tube switch rotation relay feedback error
1026	4134	Tube switch error	Tube switch motor position error
1027	4135	Tube switch error	Tube switch motor feedback error
1028	4136	Tube switch error	Tube switch motor is in the opposite position
1030	4144	Tube switch error	Tube switch config reply error
1031	4145	Tube switch error	Tube switch status reply error
1032	4146	Tube switch error	Tube switch motor move refused
1033	4147	Tube switch error	Tube switch rotor capa activation error
1100	4352	Ingrid error	Ingrid communication watchdog error
1101	4353	Ingrid error	Ingrid repetition rate higher than 100 fps
1102	4354	Ingrid error	Inter grid CMD time shorter than 0.5ms
1103	4355	Ingrid error	Ingrid power supply voltage lower than 130V

Error Code Hex --- Dec.		Error Code	Description
1104	4356	Ingrid error	Ingrid power supply voltage higher than 200V
1105	4357	Ingrid error	Ingrid feedback error
1107	4359	Ingrid error	Grid feedback voltage too High
1109	4361	Ingrid error	Bias feedback voltage too High
1110	4368	Ingrid error	Ingrid target DAC voltage feedback fault
1180	4480	Hardware error	Ingrid not active
1181	4481	Exposure error	mA between pulses
1182	4482	Hardware error	Ingrid CAN bus off
1199	4505	Ingrid error	Ingrid error
1201	4609	Heater Error	Heater 1: no CAN message received within 5 secs
1202	4610	Heater Error	Heater 1: database not correct
1203	4611	Heater Error	Heater 1: inverter permanent overcurrent
1204	4612	Heater Error	Heater 1: filament permanent open circuit
1205	4613	Heater Error	Heater 1: inverter permanent short circuit
1206	4614	Heater Error	Heater 1: filament Overload Pre-heat
1207	4615	Heater Error	Heater 1: filament Overload Boost
1208	4616	Heater Error	Heater 1: filament Overload Heat
1209	4617	Heater Error	Heater 1: command error
1210	4624	Heater Error	Heater 1: PWM rate too low
1211	4625	Heater Error	Heater 1: PWM rate too high
1212	4626	Heater Error	Heater 1: MAINS_DROP has failed
1213	4627	Heater Error	Heater 1: PRD error (Z3 Z4 = bitmap)

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Error Code Hex --- Dec.		Error Code	Description
1214	4628	Heater Error	Heater 1: boost too long
1215	4629	Heater Error	Heater 1: filament selection error
1216	4630	Heater Error	Heater 1: current feedback not nul when inverter off
1221	4641	Heater Error	Heater 1: filaments database tube1 err (Z3= LF Z4=SF)
1222	4642	Heater Error	Heater 1: filaments database tube2 err (Z3= LF Z4=SF)
1223	4643	Heater Error	Heater 1: filaments database tube3 err (Z3= LF Z4=SF)
1224	4644	Heater Error	Heater 1: filaments database tube4 err (Z3= LF Z4=SF)
1251	4689	Heater Warning	Heater 1: received command is not OK
1252	4690	Heater Warning	Heater 1: command not OK
1253	4691	Heater Warning	Heater 1: no CAN message received within 4 secs
1254	4692	Heater Warning	Heater 1: inverter overcurrent (inverter1) (<3 times)
1255	4693	Heater Warning	Heater 1: Filament open circuit (inverter1) (<3 times)
1256	4694	Heater Warning	Heater 1: inverter short circuit (inverter1) (<3times)
1257	4695	Heater Warning	Heater 1: tube switch while filaments not OFF
1258	4696	Heater Warning	Heater 1: CAN Domain command number error
1259	4697	Heater Warning	Heater 1: CAN Domain request with no transfer init
1260	4704	Heater Warning	Heater 1: CAN Domain Toggle bit error
1261	4705	Heater Warning	Heater 1: CAN Domain : less than 2 data to download
1262	4706	Heater Warning	Heater 1: CAN Domain Abort received & applied
1263	4707	Heater Warning	Heater 1: database download while heater not cut
1280	4736	Hardware error	Heater 1 board com pb
1281	4737	Hardware error	Heater 1 board has reset

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Error Code Hex --- Dec.		Error Code	Description
1299	4761	Heater Warning	Heater 1: unknown warning
1301	4865	Com errors	AEC Board com problem
1401	5121	Application warning	Saved RAM Battery life time limit reached
1402	5122	Hardware error	Internal CAN bus off
1403	5123	Hardware error	Connectic Fault
1404	5124	Hardware error	FPGA configuration problem
1405	5125	Thermal error	Tank temp meas too low
1406	5126	Exposure error	Time counter problem
1406	5126	Thermal error	Inverter Temp meas too low
1407	5127	Exposure error	mAs counter problem
1408	5128	Exposure error	AEC does not count
1409	5129	Exposure error	mAs meter saturated
1410	5136	Exposure error	FPGA locked
1411	5137	Exposure error	Time counter problem
1412	5138	Thermal error	Lp Temp meas too low
1420	5152	Exposure error	Tomo cut too early
1421	5153	Exposure error	Tomo cut by generator
1450	5200	Hardware error	Hardware Inverter Error
1452	5202	Hardware error	Incorrect KVmA Test Sel
1453	5203	Thermal error	Rotor Thermal error
1454	5204	Exposure error	Inverter thermal error
1500	5376	Manipulation error	Tomo brightness not good

Diagnostics

Error Code Hex --- Dec.		Error Code	Description
1501	5377	Manipulation error	Exposure switch release
1502	5378	Manipulation error	AEC does not cut exposure

The following error codes are not errors returned by the generator, but represent either a communication protocol error or a timeout waiting for the generator to complete an action.

10004	Timeout waiting for filament prep in Digital Spot
10006	Timeout waiting for filament prep in film
10470	Frame rate not accepted by generator
10481	Technique not accepted by generator
10496	AEC configuration not accepted by generator
10520	
10719	Anode thermal data not returned by generator

Detailed Generator Errors

The simplified error code (XX) should be used to find the general Error code area, then the Hexadecimal error code (XXXXH) will locate the specific Potential Cause and Recommended Action/Troubleshooting Guide in the following tables.

Tube Detection Errors (30)

Tube Detection Errors (30)			
Error code	Message/*explanation*	Potential Cause	Recommended action/ Troubleshooting guide
0305H	FPGA Problem	(Restarting safety Signal)	Error is detected and recovered automatically without noticeable effect on the system, such as an error related to recovered tube arcs. Errors usually occur during exposure. - Do power and grounding check. - If too frequent, replace kV Control PCB.
0324H data=4*	Tube arc (kV+ and kV- dropped) *kV drop/arc detected*	X-ray tube arc (arc, spark between anode and cathode) Anode HV cable HV tank	Usual in tubes. If too frequent, and varies with HV: replace x-ray tube. - Run open load kV test. If fails, replace anode HV cable. (See *Diagnostics* section.) - Check HV cables and tube contacts for grease/oil or black traces. - Swap and connect HV cables. - Replace tube.

Tube Detection Errors (30)			
Error code	**Message/***explanation*	**Potential Cause**	**Recommended action/ Troubleshooting guide**
0324H data=1* (see note)	Tube arc (kV+ has dropped) *kV drop/arc detected on Anode side*	1. Anode side Tube arc. 2. Anode HV cable 3. HV tank 4. Arc counter overflow	If too frequent: - Check HV cables and tube contacts for grease/oil or black traces. - Tube problem. (Anode side) - Check cable by interchanging them. - Run Open load kV test. If fails, replace anode HV cable. - Otherwise, HV tank.
0324H data=2* (see note)	Tube arc (kV- has dropped) *kV drop/arc detected on cathode side*	1. Cathode side Tube arc. 2. Cathode HV cable 3. HV tank	If too frequent: - Check HV cables and tube contacts for grease/oil or black traces. - Tube problem. (Cathode side) - Check cable by interchanging them. - Run Open load kV test. If fails, replace anode HV cable. - Otherwise, HV tank

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Tube Detection Errors (30)			
Error code	Message/*explanation*	Potential Cause	Recommended action/ Troubleshooting guide
0324H data=8* (see pg 10)	kV regulation error *This is a slow speed safety circuit in case of "smooth" arcs or a case of a regulation problem.*	1. smooth HV tube arcs 2. PPC kV Control PCB (HV regulation problem) 3. too high line impedance 4. half of AC/DC capacitors open 5. Inverter (parallel inductor or filtering capacitors) 6. HV tank	- Run inverter diagnostics - Run Open load kV test. - Troubleshoot tube and contacts of HV cable. - Check DC bus voltage and AC line fuses/voltage.
0305H	Re-starting safety. (unknown reason) *Error occurring on safety line, while No root error present at the error inputs (Err 0301 to 0304). This is probably due to transient interference (Spikes).*	1. External unknown cause. 2. kV Control PCB.	- Do a power and Grounding Check. Verify cabling and contacts. - If permanent or too systematic, replace kV Control PCB. - Run inverter diagnostics Report to engineering.

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* **Note to the error 0324H:**

The generator sends only one message of error for all the arcs (0324H) at the end of the exposure. During the same exposure, there may have been different kind of arcs.

In the *data* of this error, we can distinguish between the different arcs:

1. Arc in anode side

2. Arc in cathode side

4. Arc in both sides

8. kV regulation error.

For an exposure with anode and both sides arc, the data will be "5"

These data can be displayed in the workstation in decimal or in hexadecimal base.

Anode Rotation Errors (40)

Anode Rotation Errors (40)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0101H	No CAN message received within 5 sec's *The rotation PCB has not received any signal from the PPC kV Control main software for the last 5 sec., interpreted as a loss of communication*	1. kV Control PCB main software lost 2. kV Control PCB or Rotation PCB driver failure 3. Bad contact on one of the pin on the CAN bus line connector	- Unlikely to happen. This is a debug error. - Retry - Reinitialise and retry If error persists, report it to Engineering
0102H	Data base not correct. *The firmware of the rotation PCB has detected that the data base received from the kV Control PCB has wrong data.*	1. Wrong kV Control database. It can only happen at power up.	- Reload NVRam database. - Ultimate is to replace Rotation PCB.

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Anode Rotation Errors (40)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0103H	Rotation current overload *Rotation PCB has detected Main or auxiliary Rotation current too high compared to the max. Tube motor current.*	1. Rotation PCB 2. Rotation PCB phase capacitor short circuited 3. Wrong data base (improbable)	Check stator windings impedance (16/47 ohm). If not OK, replace tube. Check wiring from rotation board to tube. Check that phase shift capacitors are correctly connected and not in short circuit. Run Rotation diagnostic (See diagnostic section). If test fails, replace Rotation board
0104H	Rotation current open load *Rotation PCB detected that no current is flowing to the motor.*	1. Tube stator winding is open circuit: x-ray tube 2. Incorrect wiring (Open) 3. No DC bus on Rotation PCB 4. Rotation PCB 5. Rotation PCB phase capacitor not connected	Disconnect rotation-to-tube-stator cable and check stator windings impedance (16/47 ohm). If open circuit, replace tube. Check wiring from rotation board to tube. Check DC bus voltage present on rotation board. Troubleshoot cables and fuses from AC-DC board to rotation board Check that phase shift capacitors are correctly connected Run Rotation diagnostic (See diagnostic section). If test fails, replace Rotation board

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Anode Rotation Errors (40)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0105H	Rotation Phases unbalanced *The amplitude difference of the current between main and auxiliary is too large.*	1. One Rotation wire missing 2. Rotation PCB 3. Rotation PCB phase capacitors inverted or wrong value or not connected 4. Wrong tube configuration data base 5. Tube problem (stator)	Disconnect rotation-to-tube-stator cable and check stator windings impedance (16/47 ohm). If not OK, replace tube. Check wiring from rotation board to tube. Check that phase shift capacitors are correctly connected. Check that phase shift capacitors are not in short-circuit. Run Rotation diagnostic. If test fails, replace Rotation board.
0106H	Rotation phase error *The Rotation PCB has detected that the current in the anode stator does not show the correct phase shift between main and auxiliary.*	1. Rotation PCB 2. Tube problem (stator) 3. Rotation PCB phase capacitors inverted or wrong value	Disconnect rotation-to-tube-stator cable and check stator windings impedance (16/47 ohm). If not OK, replace tube. Check wiring from rotation board to tube. Check that phase shift capacitors are not swapped, check connection Check that phase shift capacitors are not in short-circuit Run Rotation diagnostic. If test fails, replace Rotation board

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Diagnostics

Anode Rotation Errors (40)			
Error code	**Message/*explanation***	**Potential cause**	**Recommended action/ Troubleshooting guide**
0107H	Rotation Inverter permanent overcurrent *An overcurrent has been detected and 3 restart have been tried unsuccessfully within a single rotation state*	1. Rotation PCB 2. Tube stator winding in short circuit 3. Wiring incorrect (shorted)	Check stator windings impedance (16/47 ohm). If not OK, replace tube. Check wiring from rotation board to tube. Check that phase shift capacitors are correctly connected and not in short circuit. Run Rotation diagnostic. If test fails, replace Rotation board
0108H	Command Error	Hardware failure, software application, communication error.	- Reset system - Issue new command
0109H	MAINS_DROP has failed *The firmware of the rotation PCB has detected the mains_drop signal activation and transmitted error to kV Control*	1. Interference (spikes) 2. Mains have dropped 3. Cable or connector contact in DC bus between power unit and auxiliary unit 4. Rotation PCB	Check if LVPS400 power supply is abnormally down. Reset system. If error persists, check flat cable between LVPS400 and heater boards. If cable is OK, replace LVPS400 board.

Anode Rotation Errors (40)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0110H	PRD error(Z3Z4=bitmap) *Firmware checksum, RAM test and EPLD access are performed at power up or reset.*	Rotation PCB	Reset. If error persists, replace Rotation board.
0111H	F0 main frequency problem. *EPLD has not applied the inverter start command*	Rotation PCB	-Retry -Replace Rotation PCB.
0112H	Rotor HW/FW Config error	Rotation PCB	Download official data base If the problem persists, change rotation PCB
0149H	Unknown rotation error. *The main software received an error from rotation PCB with no error code associated*	Software problem	No action.
0162H	Acceleration while in error	Hardware failure, software application, communication error.	- Reset system - Issue new command

Anode Rotation Errors (40)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0163H	No CAN message received w/i 4 sec.	Hardware failure, software application, communication error.	Unlikely to happen. This is a debug error. If error persists report to Engineering

Anode Rotation Errors

Associated data structure:

PRD error (Z3/Z4 bitmap):

component failure :
0001H=RAM
0002H=RAM stack
0200H=EPLD
8000H=program checksum

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Rotation database error:

2 bytes data, each value points to a specific parameter found as being erroneous

Other errors:

rotation state (rotor Z3 bitmap):
0=inverter OFF
1=acceleration 0 to low speed
2=acceleration 0 to high speed
3=acceleration low speed to high
4=low speed run
5=high speed run
6=high speed to low speed brake
7=brake reverse
8=brake DC

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Filament Heater Errors (50)

Filament Heater Errors (50)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0201H	No CAN message received within 5 sec's *The Heater PCB has not received any command from the kV Control main software for the last 5 sec., interpreted as a loss of communication*	1. kV Control main software lost 2. kV Control or Heater PCB driver failure 3. Bad contact on one of the pin on the CAN bus line connector	-Unlikely to happen. This is a debug error. -Retry -Reinitialize and retry.
0202H	Database not correct	Hardware failure, software application, communication error.	- Reset system - Issue new command
0203H	Heater inverter permanent overcurrent.(SW limit) *Issued by the heater PCB when an overcurrent has been detected and 3 restarts have been tried without success within 100 ms*	1. Heater PCB	-Check cabling of heater. -Restart. If persistent, replace Heater PCB

Filament Heater Errors (50)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0204H	Filament permanent open circuit. *Issued by the heater PCB when an open has been detected and 3 restarts have been tried without success within 100 ms*	1. X-ray tube filament open 2. Heater to HV tank cable 3. Cathode HV cable or pin contacts 4. Open circuit in filament transformer inside HV Tank.	Unplug cathode HV cable on generator side. Measure impedance between pins. If open circuit, check connection between cathode HV cable and tube, and impedance between pins of tube HV receptacle. Replace tube or HV cable. If no open circuit, check Heater to HV tank cable (3 cables) If cable OK, swap heater boards and check errors. If open circuit error is reported on the other filament, replace heater board. If open circuit error is reported on the same filament, check HV Tank heater transformers (cable connector on top of JEDI inverter for primary winding, cathode HV receptacle for secondary. Replace HV tank.
0205H	Heater Inverter permanent short circuit (HW limit) *Issued by the heater PCB when a short circuit has been detected and 3 restarts have been tried without success within 100 ms*	1. Heater PCB	-Restart. If persistent, replace Heater PCB

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Filament Heater Errors (50)			
Error code	**Message/*explanation***	**Potential cause**	**Recommended action/ Troubleshooting guide**
0206H	Filament current too high on inverter 1 for "Pre-Heat" *This is the result of an integrated value of the RMS current measurement on Heater PCB comparison with max. Tube value in data base.*	1. Tube data base or calibration 2. Heater PCB	-It's unlikely, but reload NVRam database. -Replace heater PCB.
0207H	Filament current too high on inverter 1for "Boost" *Same as above*	1. Tube data base or calibration 2. Heater PCB	Same as above
0208H	Filament current too high on inverter 1for "Heat" *Same as above*	1. Tube data base or calibration 2. Heater PCB	Same as above
0209H	Command Error	Hardware failure, software application, communication error.	- Reset system - Issue new command
0210H	Current over estimated fork range – PWM rate too low *RMS filament current measurement (every 0.5 ms) on heater PCB is too low*	1. short circuit 2. Heater PCB	Verify that 160V is present on Heater board (DS3 on heater board, see block diagrams) Check cabling from LVPS board. If 160V ok, replace heater board.

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Filament Heater Errors (50)			
Error code	**Message/***explanation*	**Potential cause**	**Recommended action/ Troubleshooting guide**
0211H	Current under estimated fork/ range – PWM rate too high *RMS filament current measurement (every 0.5 ms) on heater PCB is too high*	1. Open circuit 2. Heater PCB	Unplug cathode HV cable on generator side. Measure impedance between pins. <u>If open circuit</u>, check connection between cathode HV cable and tube, and impedance between pins of tube HV receptacle. Replace tube or HV cable. <u>If no open circuit</u>, check Heater to HV tank cable (3 cables) If cable OK, swap heater boards and check errors. If open circuit error is reported on the other filament, replace heater board. If open circuit error is reported on the same filament, check HV Tank heater transformers (cable connector on top of Generator inverter for primary winding, cathode HV receptacle for secondary. Replace HV tank.
0212H	MAINS_DROP detected. *The firmware of the Heater PCB has detected the mains drop signal activation and has transmitted error to kV Control*	1. Interference (spikes) 2. Mains drop 3. Cable or connector contact in DC bus between power unit and auxiliary unit 4. Heater PCB	Check if LVPS400 power supply is abnormally down. Reset system. If error persists, check flat cable between LVPS400 and heater boards. If cable is OK, replace LVPS400 board

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Filament Heater Errors (50)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0213H	PRD error (Z3 Z4 = Bitmap) *Firmware checksum, RAM test and EPLD access are performed at power up or reset.*	Heater PCB	Try again. If the error persists, replace the heater PCB.
0214H	Boost too long on inverter1. *Boost command stayed longer than 400ms*	May be a loss of communication during boost.	Retry. It will probably be followed by another communication code. Troubleshoot comm. Error.
0215H	Filament selection error. *The relay on the Heater PCB selecting the filament is in the wrong position with respect to the selection*	Heater PCB	Replace Heater PCB
0216H	Current feedback not null when inverter OFF *Inverter current has been measured while the inverter was not commanded*	Heater PCB	Replace Heater PCB
0221H 0222H 0223H 0224H	Filament Database Tube1-4 not correct *The firmware of the heater PCB has detected that the Received Data base from kV Control contains erroneous data for Tube 1, 2, 3, or 4.*	Wrong kV Control data base. It can only happen at power up.	Reload database. If error persists, replace Heater board. If no error, perform tube filament calibration.

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Diagnostics

Filament Heater Errors (50)			
Error code	**Message/*explanation***	**Potential cause**	**Recommended action/ Troubleshooting guide**
0248H	Heater Large Focus error *The main software received an error from heater PCB with no error code associated*	Software problem	No action
0249H	Heater Small Focus error *The main software received an error from heater PCB with no error code associated*	Software problem	No action

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Filament Heater Errors

Associated Data Structure:

PRD error :

Component failure :
0001H=RAM
0002H=RAM stack
0200H=EPLD
8000H=program checksum

Filament Database Error:

2 bytes bitmap (LSByte=small focus, MSByte=large focus)

Each bit points to an erroneous parameter

Other Errors :

1 byte bitmap with the following structure:

bit7 (MSB)	bit6	bit5	bit4	bit3	bit2	bit1	bit0 (LSB)
focus selected	tube selected			small focus state		large focus state	
0=small focus selected 1=large focus selected	1=tube 1 selected 2=tube 2 3=tube 3 4=tube 4			0=inverter OFF 1=preheat 2=boost 3=heat		0=inverter OFF 1=preheat 2=boost 3=heat	

Exposure Errors (60)

Exposure Errors (60)			
Error code	**Message/***expla nation*	**Potential cause**	**Recommended action/ Troubleshooting guide**
0306H	No kV feedback on anode side *kv measured <12kV 0,5ms after start of exposure on anode side only*	1. HV cable short circuit 2. HV tank 3. kV Control PCB (less probable)	Remove anode HV cable on generator side and verify that there is no short-circuit between pins and ground. Verify flat cable connection between PPC kV control and HV tank. Remove anode and cathode cables on generator side and run no load HV diagnostic. If test fails, replace PPC kV Control board or HV tank.
0307H	No kV feedback on cathode side *kv measured <12kV 0,5ms after start of exposure on cathode side only*	1. HV cable short circuit 2. HV tank 3. kV Control PCB (less probable)	Remove anode HV cable on generator side and verify that there is no short-circuit between pins and ground. Verify flat cable connection between PPC kV control and HV tank. Remove anode and cathode cables on generator side and run no load HV diagnostic. If test failed, replace PPC kV Control board or HV tank.
0308H	No kV Feedback (on anode and cathode) *kv measured <12kV 0,5ms after start of exposure on both anode and cathode.*	1. HV tank 2. kV Control PCB	Verify flat cable connections between PPC kV control and HV tank. Run no load HV diagnostic. If test fails, replace PPC kV Control board or HV tank

Exposure Errors (60)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0309H	kV detected during kV diagnostics. *kV measured during inverter diagnostics while no kV must be generated.*	Improper setup before the diagnostic is run.	See HV power diagnostic in this section.
0310H	kV MAX detected *kV reached 160 kv during exposure*	kV Control PCB	Repeat the exposure. If the error persists, replace the kV Control PCB or HV Tank.
0311H	ILP current not OK. *The current in the parallel resonant circuit of the inverter did not rise at the beginning of the exposure.*	1. Inverter LC resonant circuit (Inverter coil assy, capa inverter assy, current transformers.) 2. Inverter 3. kV Control	Take some exposures. If error persists, run HV power diagnostics. Run Inverter in short circuit test. If test fails replace PPC kV control board or Inverter. Else, run no load HV test without removing HV cables. If test fails, replace HV tank

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Exposure Errors (60)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0312H	ILR current not OK *The current in the serial resonant circuit of the inverter did not rise at the beginning of the exposure.*	See above	Take some exposures. If error persists, run Inverter in short circuit test. If test fails replace PPC kV control board Inverter. Else, run no load HV test without removing HV cables. If test fails, replace HV tank
0313H	Inverter max. ILR current detected. *This is a hardware detection of maximum current in serial resonant circuit.*	1 spits, error 0324H data=1 or 2) 2 3 4	Take some exposures with reduced techniques (80kV). If error persists, run Inverter in short circuit test. If test fails replace Inverter or PPC kV control board. Else, run no load HV test without removing HV cables. If test fails, replace HV tank
0314H	ILR Current time out. *The current resonant frequency is lower than expected*	1. 2. 3. circuit.	Try again at various kV/mA to confine problem. If error too frequent, replace tube. If this error is associated to error 0324h kV regul out, check mains input voltage Run no load HV diagnostics removing HV cables. If test fails replace HV tank

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Exposure Errors (60)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0316H	Arc Max error. *kV Control has detected the number of tube spits during exposure has reached the limit (see theory of operation, software section)*	Reasonably, x-ray tube	Try again at various kV/mA to confine problem. If error too frequent, replace tube. If this error is associated to error 0324h kV Regulator PCB out, check mains input voltage Run no load HV diagnostics removing HV cables. If test fails replace HV tank
0317H	Arc Ratio error. *kV Control has detected the rate of tube arcs during exposure has reached the limit (see theory of operation, software section)*	reasonably x-ray tube	Try again at various kV/mA to confine problem. If error too frequent, replace tube. If this error is associated to error 0324h kV Regulator PCB out, check mains input voltage Run no load HV diagnostics removing HV cables. If test fails replace HV tank.

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Exposure Errors (60)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0318H	kV did not reach 75% (rad) or 95% (gridded) after 20ms. *Indicates that there was no HV ON signal generated for exposure time count-up*	1. kV Control 2. Tank 3. Tube, HV cables	Repeat the exposures. If error persists run Inverter gate command diagnostic. If test fails replace PPC kV control board (first) or Inverter. If test OK remove HV cables and run no load HV diagnostics at several kV stations to confine the problem. If test fails replace HV tank. Else replace the PPC kV control board.
0319H	kV unbalanced detected. *Detects that there is more than 12kV difference between kV+ and kV -*	HV tank	-Try again at various mA to confirm the problem. Replace HV tank
0320H	FPGA problem; (Safety Signal) *No error at the inputs while checking for error source.*	1. This may be due to transient interference (Spikes). 2. SW bug	Verify flat cable and contacts between PPC kV control PCB and HV tank. Check the presence of the ferrite in the cable between PPC kV control board and HV tank. If error permanent or too systematic, replace PPC kV control PCB.

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Exposure Errors (60)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0323H	ILP and ILR current not OK No inverter current measured at the beginning of the exposure	1. Inverter LC resonant circuit. (Inverter coil assy, capa inverter assy, current transformers.) 2. Inverter 3. kV Control PCB	Check main DCBUS voltage on inverter Take some exposures. If error persists, run HV power diagnostics. Run Inverter in short circuit test. If test fails, replace Inverter or PPC kV control PCB.
0325H	DSP overload	kV Control PCB	Check main DCBUS voltage on inverter Take some exposures. If error persists, run HV power diagnostics. Run Inverter in short circuit test. If test fails replace Inverter or PPC kV control board. Else, run no load HV test without removing HV cables. If test fails, replace HV tank
0326H	DSP exposure stop	kV Control PCV	Try again. If error repeats, replace the kV Control PCB.
0327H	DSP regul out of range	kV Control PCV	Check HV cables connections Run 2nd tube capability diagnostic Replace HV tank

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Exposure Errors (60)

Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0401H	No mA feedback *mA measurement function:* *kV Control PCB has detected no mA feedback 20 ms after the beginning of the exposure.*	1. HV tank 2. kV Control PCB 3. x-ray tube (filament open or short circuited) 4. Cathode HV cable short-circuited 5. Misconnection between HV+ and HV- after a tank replacement 6. Heater function	Run 2nd tube capability diagnostic (only for 2 tube HV tank) Verify that HV cables are not swapped Verify filament impedance between pins of cathode HV cable. Disconnect HV Tank to PPC kV control flat cable and verify with an Ohm-meter that the value of the mA shunt resistors on the HV tank is 5 ohm (between pins 45 and 46 of 50 pin female connector). If it is out of range (4.9 to 5.1 Ohm, including DVM accuracy) replace HV Tank. Replace PPC kV control PCB
0402H	mA scale error *mA has been measured to be either too low or too high with respect to mA demand 20 ms after the beginning of the exposure*	1. kV Control PCB 2. Default filament currents not correctly adjusted 3. HV Tank (improbable)	If the tube has just been replaced or installed, run many exposures until the filament correction adjusts the default filament drive values. If the error occurs after a while on a system Disconnect HV Tank to PPC kV control flat cable and verify with an Ohm-meter that the value of the mA shunt resistors on the HV tank is 5 ohm (between pins 45 and 46 of 50 pin female connector). If it is out of range, (4.9 to 5.1 Ohm, including DVM accuracy) replace HV Tank. Replace PPC kV control board

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Exposure Errors (60)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0403H (Class 2 error)	mA out of range *Measured mA every 50 msec exceeded 5% of mA demand.* *This error is logged, but does not stop the exposure.*	Tube arc	No action
0451H	MA meter saturated	Tube arc	No action
0504H	Inverter Gate Power Supply error *Gate supply voltage has dropped below the level required to drive the IGBTs properly*	1. Inverter (gate command PCB) 2. kV Control PCB 3. Generator input voltage too low or line impedance too high	Verify DC BUS voltage present in ACDC module. Check main AC fuses and DCBUS voltage. Verify DC BUS voltage present in Gate Cmd PCB (neon ON) If neon off, Verify DC BUS voltage present in rotation board (neon ON) If neon on , verify cabling to Gate cmd PCB. If neon off, check fuse in ACDC PCB. If fuse has blown, check if the DCBUS input to rotation board or Gate cmd PCB is in short circuit and replace the Rotation PCB or the inverter. If DC BUS ok, run Inverter gate command diagnostics If test fails, replace PPC kV control PCB (first) or Inverter.

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Exposure Errors (60)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
0801H	Exposure backup mAs exceeded *The exposure command last so long that the maximum mAs allowed has been reached*	1. Exposure command line stuck to the active state	Reset and retry changing parameters and duration. If error persists, replace PPC kV control PCB.
0802H	Exposure backup time exceeded. *The exposure command last longer than the duration that was loaded by the system (Backup time + 5%.)*	1. System 2. System-Generator cable 3. I/F PCB: Exposure line stuck in the active state	Reset and retry changing parameters and duration. If error persists, replace PPC kV control PCB
0803H	Exp cmd while gen. not ready. *Generator received an exposure command while not in ready state*	1. Software bug/problem 2. Cable / communication problem 3. External cause (Spikes)	If problem is persistent, check heater, anode rotation and system to Generator preparation command to find the root cause for the Generator not to be ready. Change Generic IF PCB or kV Control PCB.

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Exposure Errors (60)			
Error code	Message/*explanation*	Potential cause	Recommended action/ Troubleshooting guide
1407H	mAs counter problem *Error found in verifying the counter normal operation.*	kV Control PCB	Replace kV Control PCB
1408H	AEC counter error. *If there is no AEC feedback in AEC station exposure.*	1. ION chamber 2. AEC cable, connection 3. AEC PCB	Verify AEC board to ion chamber cable and Generic IF to PPC kV control board cable. Run AEC diagnostics (In this section). If test OK, replace ion chamber. If test fails, replace AEC board or PPC kV control PCB or Generic IF PCB.
1409H	mAs meter saturated. *A check is done on mAs counter operation at the beginning of exposure and found the mAs meter with unrealistic value.*	1. kV Control PCB	Replace kV Control PCB

Exposure Errors (60)			
Error code	**Message/*explanation***	**Potential cause**	**Recommended action/ Troubleshooting guide**
1410H	FPGA locked. FPGA detected an error and did not allow start exposure after exposure command signal was received.	1. Software bug 2. kV Control PCB	If persistent replace kV Control PCB
1411H	Time counter problem *Error found in verifying the counter normal operation.*	kV Control PCB	Replace kV Control PCB

Power Supply (70)

Power Supply (70)			
Error code	Message/explanation	Potential cause	Recommended action/ Troubleshooting guide
0501H	DC bus out if range (<400 or >850)	1. Mains problem (Too low or too high) 2. One phase missing at Generator input	-Check mains line 3 phases incoming voltage (if system is 65kW or 80 kW) -Verify line impedance if mains is low.
0503H	Inverter Gate Power Supply error (checked at prep)	1. Mains 2. Cable 3. Gate command PCB (Inverter) 4. kV Control	Verify DC BUS voltage present in ACDC module. Check main AC fuses and DCBUS voltage. Verify DC BUS voltage present in Gate Cmd PCB (neon ON) If neon off, Verify DC BUS voltage present in rotation PCB (neon ON) If neon on , verify cabling to Gate cmd PCB. If neon off, check fuse in ACDC board.If fuse has blown, check if the DCBUS input to rotation board or Gate cmd PCB is in short circuit and replace the Rotation PCB or the inverter. If DC BUS ok, run Inverter gate command diagnostics If test fails, replace PPC kV control PCB (first) or Inverter.
0505H	Mains power supply has dropped During exposure	Unknown	None

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Power Supply (70)			
Error code	Message/explanation	Potential cause	Recommended action/ Troubleshooting guide
0506H	DC bus 1 phase pre-charge error. *Found DC bus did not reach 400V after 30 sec.* *Charge relay is not activated and pre-charge relay drops.*	1. Pre-charge resistor 2. Relay 3. ACDC module 4. LVPS 5. kV Control PCB	***WARNING!: Potential residual voltage. Make sure all the LEDs are off. Verify with a voltmeter, range 400VDC that there is no voltage on the capacity bench before any intervention.*** Verify neon DS2 on ACDC indicating voltage presence on capacitors. If neon ON during pre-charge, check DCBUS cable between ACDC and quad snubber board in Inverter Listen to relay clicking at power on. Check charge and discharge resistors Replace ACDC 1 Phase module
0507H	DC bus 1 phase discharge error. *Found that DC bus voltage is > 30 V before pre-charge.*	ACDC	Power off and wait 1 minute before reapplying power to system. If error persists replace ACDC 1ph module

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Hardware Errors (80)

Hardware Errors (80)			
Error code	Message/explanation	Potential cause	Recommended action/ Troubleshooting guide
0180H	Rotation PCB communication problem. *kV Control PCB communication Watch Dog with Rotation PCB popped up because it did not get reply from Rotation PCB.*	1. Rotation PCB 2. Control bus cable 3. kV Control PCB	A. Check that rotation firmware is running (DS5 LED is blinking). If no: 1. Verify rotation PCB 5V: LED DS3 is lit. If no: verify DS1/DS2 LEDs : if they are lit, replace rotation PCB, else go to +/-15V errors troubleshooting 2. Verify that RESET LED is not lit. If it is lit, disconnect successively the control bus cable from heater and kV Control PCB to find the PCB which is holding the reset line and replace it. If after disconnecting all the PCBs, the LED remains lit, replace the Rotation PCB 3. Else replace Rotation PCB B. Verify the flat cable between kV Control PCB and auxiliary module is correctly connected to the Rotation PCB C. Else replace kV Control PCB

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Hardware Errors (80)			
Error code	Message/explanation	Potential cause	Recommended action/ Troubleshooting guide
0181H	Rotation PCB has reset. *kV Control PCB has detected the Rotation PCB - has reset. KV Control - will reload Rotation data base.*	1. Rotation PCB 2. Interference (Spikes)	-Reinitialize system, retry. -If persistent, replace Rotation PCB or check power and grounding.
0280H	Heater 0 PCB communication problem. *kV Control PCB communication Watch Dog with Heater PCB popped up because it did not get reply from Heater PCB.*	1. Heater PCB 2. Control bus cable 3. kV Control PCB	A. Check that heater firmware is running (DS1/2 LEDs are lit successively). If no: 1. Verify heater PCB 5V: J3/pin2. If wrong: verify +15V/-15V (J3, pin3, 4): if they are right, change rotation PCB, else go to +/-15V errors troubleshooting. 2. Verify that RST LED is not lit. If it is lit, disconnect successively the control bus cable from LVPS to rotation and kV Control to find the PCB which is holding the reset line and replace it. If after disconnecting all the PCBs, the LED remains lit, replace Heater PCB. 3. Else: replace Heater PCB. B. Verify the flat cable between kV Control PCB and auxiliary module is correctly connected until the heater PCB. C. Else: replace kV Control PCB.

Hardware Errors (80)			
Error code	Message/explanation	Potential cause	Recommended action/ Troubleshooting guide
0281H	Heater 0 PCB has reset. *KV Control PCB has detected the Heater PCB has reset. KV Control PCB will reload Rotation PCB data base.*	1. Heater PCB 2. Interference (Spikes)	- Check the flat cable connected to the Heater PCB. -Reinitialize system, retry. -If persistent, replace PCB or check power and grounding.
0322H	kV ref ADC / DAC failed *kV Control DAC and ADC capability are permanently tested for coherency.*	KV Control PCB	Only if this error is repetitive and comes alone (Not following other errors), replace kV Control PCB.
03A0H	DSP Error	Error related to hardware, software applications, or communications.	All preparation in progress is stopped. - Reset system - Clear generator error - Change kV Control PCB

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Hardware Errors (80)			
Error code	Message/explanation	Potential cause	Recommended action/ Troubleshooting guide
0601H	RTL error (Z6 Z7 = Bitmap)	Error related to hardware, software applications, or communications.	Verify that the input voltage on LVPS PCB is in an acceptable range (CF1/CF2). If no, verify AC/DC fuse. Check 160V on CF2/1 on heater board. If OK, replace heater PCB Else, disconnect the CF2 cable and measure again on the LVPS side. If voltage is wrong, replace LVPS PCB.
0602H	External CAN bus off	1. system communication power supply (for isolated communications) 2. System communication cable 3. System Interface PCB 4. System Interface PCB to kV Control PCB flat cable 5. kV Control PCB	-Check communication cable -Check system communication power supply (if any) -Check System Interface PCB to kV Control flat cable -Replace System Interface PCB -Replace kV Control PCB
0902H	Tube Fan supply error. *Rotation PCB has detected that a wrong voltage is applied to the tube fan*	1. No 115V tube cooling supply 2. Rotation PCB	-Check presence of the AC voltage (DS6 neon) at the input of the Rotation PCB. If ok, replace the Rotation PCB

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Hardware Errors (80)			
Error code	Message/explanation	Potential cause	Recommended action/ Troubleshooting guide
1280H	Heater 1 PCB Comm. Problem	Error related to hardware, software applications, or communications.	All preparation in progress is stopped. - Reset system Clear generator error
1281H	Heater12 PCB has reset	Error related to hardware, software applications, or communications.	All preparation in progress is stopped. - Reset system Clear generator error
1402H	Internal CAN bus off *CAN device on kV Control PCB detected abnormal level on it's 2 line and sent error to the CPU*	1. kV Control PCB 2. Control bus cable 3. Heater or Rotation	Check for a short circuit on CAN lines, pins 5 & 6, of the control bus cable. Short circuit may be either on PCBs or connector/ cable. If no fault detected, replace kV Control PCB
1403H	Connection Fault *One of the flat cable connector is not connected in Generator.*	Multiple, but likely improbable.	Check connection of the following cables : PPC kV control to Generic IF PCB, PPC kV control to kV measure PCB (HV tank), kV measure to Gate cmd PCB (inverter).
1404H	FPGA configuration problem. *Detected during power up. The kV Control PCB main software cannot load the FPGA.*	kV Control PCB.	Replace kV Control PCB.

Diagnostics

Hardware Errors (80)			
Error code	**Message/explanation**	**Potential cause**	**Recommended action/ Troubleshooting guide**
1413H	Internal CAN bus txo	Error related to hardware, software applications, or communications.	Check a short circuit on CAN lines, pins 5 & 6, of the control bus cable. Short circuit may be either on PCBs or connector/ cable. If no fault detected, replace PPC kV control PCB
1414H	Internal LD CAN bus txo	Error related to hardware, software applications, or communications.	All preparation in progress is stopped. - Reset system Clear generator error
1415H	External CAN Bus txo	Error related to hardware, software applications, or communications.	All preparation in progress is stopped. - Reset system Clear generator error

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Application Errors (90)

Application Errors (90)			
Error code	**Message/explanation**	**Potential cause**	**Recommended action/ Troubleshooting guide**
0701H	Saved RAM checksum problem. *Generator kV Control PCB has detected corruption in the NV Ram verification (After power up)*	1. Database problem 2. External cause (Spikes) 3. kV Control PCB	If persistent: -Reload the Data base. If no improvement: -Replace kV Control PCB and reload the data base.
0702H	Software problem.	1. Software or Data Base problem. 2. kV Control PCB failure.	-Reload the Data base -Reload the software and database If no improvement: -Replace kV Control PCB
0704H	Rotation/Heater PCB hold too long. *Will pop up if preparation command from the system is maintained longer than 3 minutes.*	Software problem.	No action

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Application Errors (90)			
Error code	**Message/explanation**	**Potential cause**	**Recommended action/ Troubleshooting guide**
0705H	System or database configuration error *The identifier of the system and the database are not compatible*	1. Database problem	Download the Data base - Check system software release (Workstation)
0706H	Wrong DSP version *(Engineering debug)*	PPC kV control board	-Reload the software and database If no improvement, change PPC kV control
0707H	Wrong FPGA version *(Engineering debug)*	PPC kV control board	-Reload the software and database If no improvement, change PPC kV control
1011H	Unexpected tube switch PCB	Database problem	Reload the database

Communication Errors (100)

Communication Errors (100)			
Error code	Message/explanation	Potential cause	Recommended action/ Troubleshooting guide
0603H	Debug screen com. error	Engineering use	
1301H	AEC PCB comm. problem. *AEC communication problem*	1. Verify cables connection 2. AEC PCB 3. Interface PCB	Verify flat cable between Generic IF PCB and AEC PCB. Check if AEC PCB is alive (leds blinking, refer to block diagrams) If PCB down and cable OK, replace AEC PCB In case of a problem with +12V supply from system to GEN_IF PCB this error will show associated with communication errors.

Thermal Errors (110)

Thermal Errors (110)			
Error code	Message/explanation	Potential cause	Recommended action/ Troubleshooting guide
0804H	Tank Thermal Sensor too high *HV tank temperature measurement has reached 67 degree C.*	1. HV tank too hot; normal error 2. HV tank 3. kV Control PCB	Wait until HV cools down for error clearance. Check that heatsink fans are working properly. If not, replace fans. If error persists when HV Tank is cool, check flat cable connection between HV Tank and PPC kV control PCB. Replace PPC kV control PCB. Replace HV tank.

Thermal Errors (110)			
Error code	Message/explanation	Potential cause	Recommended action/ Troubleshooting guide
0805H	Inverter thermal too high. *Parallel inductor has reached 80°C*	1. Fan of the inverter (most probable) 2. Sensor of parallel inductor 3. kV Control PCB	Check the activity of the fan of the power module. If it is not working, check the fan voltage. If it is >14Vdc and the fan is not running, replace the fan. If the voltage is OK check the connection of the sensor cable on J5 on Gate cmd PCB. If all is OK, replace kV Control PCB. If the problem persists, replace the inverter.
0903H	Tube exceeded 70 degree C *70° loop detected open*	1. X-ray tube too hot; normal error 2. Cooling problem 3. Wiring problem 4. Sensor problem (Tube) 5. Rotation PCB	-Wait for error clearance -If persistent : 1. Check tube cooling (Fan), troubleshoot 115 volts from PDU to Fans, through Rotation PCB; check tube thermal sensor 2. Short circuit the sensor feedback on Rotation PCB connector and verify that error disappears. If no, replace Rotation PCB
0905H	Tube thermal protection *Thermal protection algorithm has detected that tube exceeded its tempreature limits*	1. X-ray tube too hot; normal error 2. Too powerful exposures	Wait until tube cools down for error clearance. Reduce exposures technique (kV, mA)
1405H	Tank temperature measures too low. *Means that t° value of the HV tank is < 3°C*	kV Control PCB HV tank	Replace kV Control PCB Replace HV Tank

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Thermal Errors (110)			
Error code	**Message/explanation**	**Potential cause**	**Recommended action/ Troubleshooting guide**
1406H	Inverter temperature sensor problem. Parallel inductor is *3°C*	Fan of the inverter (most probable) kV Control PCB Sensor of parallel inductor	Check the activity of the fan of the power module. If it is not working, check the voltage of the fan. If it is >14Vdc and the fan is not running, replace the fan. If the voltage is OK check the connection of the sensor cable on J5 on Gate_cmd PCB. If all is OK, replace kV Control PCB. If the problem persists, replace the inverter.

Manipulation Errors (120)

Manipulation Errors (120)			
Error code	**Message/explanation**	**Potential cause**	**Recommended action/ Troubleshooting guide**
1501H	Release exposure switch (RAD)	During exposure switch is released	no action
1502H	AEC does not cut exposure Exposure stopped by mAs limitation	mAs limitation (most cases) Ion chamber problem AEC PCB	Increase selected mAs for the exposure. If error persists remove ion chamber and run AEC diagnostics. If test fails, replace AEC PCB, else troubleshoot ion chamber and cable.

Rotation Warning (10)

Rotation Warning (10)			
Error code	**Message / explanation**	**Potential cause**	**Recommended action/Troubleshooting Guide**
0151H	CAN Domain command number error	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0152H	CAN Domain request with no transfer init	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0153H	CAN Domain Toggle bit error	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0154H	CAN Domain : less than 2 data to download	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0155H	CAN Domain Abort received & applied	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0156H	Bad index in config upload	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0158H	Acceleration cmd while no tube selected	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log

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Rotation Warning (10)			
Error code	**Message / explanation**	**Potential cause**	**Recommended action/Troubleshooting Guide**
0159H	Acceleration cmd while database not OK	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0160H	Database download while rotor speeding	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0161H	Acceleration command not OK	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0162H	Acceleration while in error	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0163H	No CAN message received within 4 sec	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0164H	Inverter overcurrent (< 3 times)	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0199H	Unknown warning	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log

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Heater Warning (20)

Heater Warning (20)			
Error code	Message / explanation	Potential cause	Recommended action/Troubleshooting Guide
0251H	Heater 0: received command is not OK	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0252H	Heater 0: command not OK	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0254H	Heater 0: inverter overcurrent (inverter1) (<3 times)	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0255H	Heater 0: filament open circuit (inverter1) (<3 times)	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0256H	Heater 0: inverter short circuit (inverter1) (<3times)	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0258H	Heater 0: CAN Domain command number error	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0259H	Heater 0: CAN Domain request with no transfer init	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log

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Heater Warning (20)			
Error code	Message / explanation	Potential cause	Recommended action/Troubleshooting Guide
0260H	Heater 0: CAN Domain Toggle bit error	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0261H	Heater 0: CAN Domain less than 2 data to download	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0299H	Heater 0: unknown warning	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
1251H	Heater 1: received command is not OK	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
1252H	Heater 1: command not OK	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
1253H	Heater 1: no CAN message received within 4 secs	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
1254H	Heater 1: inverter overcurrent (inverter1) (<3 times)	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
1255H	Heater 1: Filament open circuit (inverter1) (<3 times)	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log

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Heater Warning (20)			
Error code	Message / explanation	Potential cause	Recommended action/Troubleshooting Guide
1256H	Heater 1: inverter short circuit (inverter1) (<3times)	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
1257H	Heater 1: tube switch while filaments not OFF	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
1258H	Heater 1: CAN Domain command number error	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
1259H	Heater 1: CAN Domain request with no transfer init	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
1260H	Heater 1: CAN Domain Toggle bit error	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
1261H	Heater 1: CAN Domain : less than 2 data to download	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
1262H	Heater 1: CAN Domain Abort received & applied	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
1263H	Heater 1: database download while heater not cut	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log

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Heater Warning (20)			
Error code	**Message / explanation**	**Potential cause**	**Recommended action/Troubleshooting Guide**
1299H	Heater 1: unknown warning	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log

LVPS Warning (25)

LVPS Warning (25)			
Error code	**Message / explanation**	**Potential cause**	**Recommended action/Troubleshooting Guide**
0508H	Warning Overvoltage > 755VDC	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0509H	Warning Undervoltage < 320VDC	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0520H	LVPS 400: received command is not OK	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0521H	LVPS 400: external +15V too high	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0522H	LVPS 400: external +15V too low	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log

LVPS Warning (25)			
Error code	**Message / explanation**	**Potential cause**	**Recommended action/Troubleshooting Guide**
0523H	LVPS 400: external +160V too high	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0524H	LVPS 400: external +160V too low	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0525H	LVPS 400: gate +24V too high	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0526H	LVPS 400: gate +24V too low	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0527H	LVPS 400: CAN +15V too high	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0528H	LVPS 400: CAN +15V too low	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0529H	LVPS 400: CAN -15V too high	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0530H	LVPS 400: CAN -15V too low	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log

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LVPS Warning (25)			
Error code	**Message / explanation**	**Potential cause**	**Recommended action/Troubleshooting Guide**
0531H	LVPS 400: heater 0 +160V too high	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0532H	LVPS 400: heater 0 +160V too low	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0533H	LVPS 400: heater 1 +160V too high	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0534H	LVPS 400: heater 1 +160V too low	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0535H	LVPS 400: main inverter +17V too high	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0536H	LVPS 400: main inverter +17V too low	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0537H	LVPS 400: main inverter +26V too high	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0538H	LVPS 400: main inverter +26V too low	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log

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LVPS Warning (25)			
Error code	**Message / explanation**	**Potential cause**	**Recommended action/Troubleshooting Guide**
0539H	LVPS 400: main inverter +160V too high	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0540H	LVPS 400: main inverter +160V too low	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0541H	LVPS 400: FAN 0 overcurrent	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0542H	LVPS 400: FAN 1 overcurrent	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0543H	LVPS 400: FAN 2 overcurrent	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0544H	LVPS 400: FAN 3 overcurrent	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0596H	LVPS 400: communication error	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0597H	LVPS 400: unknown error	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log

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Application Warning (27)

Application Warning (27)			
Error code	**Message / explanation**	**Potential cause**	**Recommended action/Troubleshooting Guide**
0404H	No Pulse Warning	Errors detected by Gen. And automatically recovered w/o effect on the system	- Errors which generally occur during exposure - Generator phase remains unchanged
0703H	Watchdog reset has just occurred (MSB)	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
0708H	Watchdog reset has just occurred (LSB)	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log
1401H	Saved RAM Battery life time limit reached	Error detected in background diagnostics while running	- No effect on system operation - Errors stored in Generator Event Log

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Other Generator Failures

Other Generator Failures			
Error code	**Message / explanation**	**Potential cause**	**Recommended action**
System	Generator does not reply to the system	1. No power on the Generator. 2. EMC filter 3. AC/DC- Diode bridge 4. Cable between AC/DC and LVPS, or mains and LVPS400 5. LVPS down 6. CAN cable problem 7. kV Control PCB 8. Generic interface 9. Rotation PCB 10. Heater PCB 11. Inverter in short circuit 12. Generator to system cable.	Perform these T/S steps: 1. kV Control PCB LEDs S0-S7 are lit successively : refer to *Reading kV Control PCB Power-on Diagnostic LEDs* in this section. 2. 2/LEDs S0-S7 show a specific pattern: refer to the above section 3. LED RESET is lit: PCB is maintained in reset either by the system or by a system I/F failure or kV Control PCB failure 4. LED HALT is lit: replace kV Control PCB 5. No LED is lit: verify that +5V on kV Control PCB (J6, pin2).is present. If yes, replace kV Control PCB. If no: 6. Verify if +15V/-15V is present (LEDs DS1/DS2). If yes, replace kV Control PCB. If no: 7. Verify if +15V/-15V is present on Rotation PCB (DS1/DS2) and the 160V is present on the heater PCB (DS3). If yes: check the control bus cable to the kV Control PCB. If no error, change the kV Control PCB. If no: 8. Verify if the LVPS DC input is right. If no, check AC/DC fuse and input line. If yes : 9. Disconnect all output cables from the LVPS PCB. Verify the +15V/-15V/160V output. If right: reconnect each PCB successively to find the one pulling the 15V to ground. If wrong, replace LVPS PCB.

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Diagnostics

Other Generator Failures			
Error code	Message / explanation	Potential cause	Recommended action
System	3 phases CB1 breaker trips in PDU/PDB, or mains fuses	1. Short circuit on the Generator: - IGBT in short circuit - ACDC or bridge rectifier in short circuit - EMC filter in short circuit	1. Disconnect DC bus cables between AC/DC and inverter (on AC/DC side) 2. Check if these cables are in short circuit. If yes, replace inverter If no: 3. Disconnect AC line cables between EMC and AC/DC (on EMC side) 4. Check if these cables are in short circuit. If yes, replace AC/DC FRU If no: 5. Disconnect AC line input from EMC PCB. Check EMC for short circuit between phases. If short circuit, replace EMC PCB.
System	Software or Data base corrupt	1. After software download: -Incorrect or uncompleted download -Checksum problem	Retry download

Reading kV Control PCB Power-on Diagnostic LEDs

Refer to the *Power-on* and *Adjustments* headings in the *Generator* section of this manual. This section provides the meaning of kV Control PCB LED status. The LED display status shows useful information at a glance to proceed to error-code based troubleshooting. When in doubt, a simple step is to watch the LED status display on the kV Control PCB, rather than the Rotation and Heater PCBs.

kV Control LED status:

The LEDs indicating the status are the yellow LEDs
DS19 to DS26 on kV Control PCB.

See the *X-Ray – ABS* section of this manual.

kV Control PCB

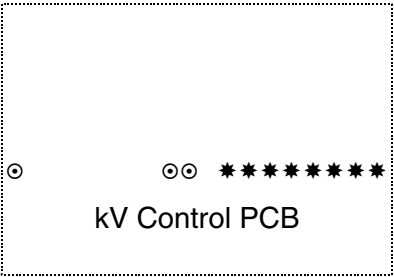S 19........................S 26

During Power On Self Tests, the 8 LEDs (S0...S7) are lit successively several time, rapidly. When the power-up diagnostics are completed, kV Control PCB is up and running.

S 19........................S 26
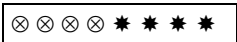
Half of the 8 LEDs are lit: Normal after the download of the boot. This can also indicate a corrupt software problem or database checksum problem. In case of a software problem, communication with the generator will not be possible. Try to download the software again or replace the kV Control PCB. In case of a database problem, an error code is logged and communication with the generator is possible. Refer to the error code description information in this manual section.

Diagnostics

S 19........................S 26

⊗ ✳ ⊗ ✳ ⊗ ⊗ ⊗ ⊗
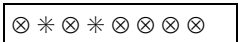
When an application error occurs, two LEDs blink, indicating the simplified error code in binary code. When the error is cleared (by a return to the standby mode, for example), the 8 LEDs are lit successively.

Heater PCB LED status:

After the power on diagnostics, the Heater PCB LEDs DS1 and DS2 are lit successively. Any different status corresponds to an abnormal situation. An error code is logged. Refer to the error code description information in this manual section.

Rotation PCB LED status:

After the power on diagnostics, the Rotation PCB LED DS5 is blinking. Any different status corresponds to an abnormal situation. An error code is logged. Refer to the error code description information in this manual section.

LVPS-400 PCB LED status:

After the power on diagnostics, the LVPS-4000 PCB LEDs DS3 and DS4 are lit successively. Any different status corresponds to an abnormal situation. An error code is logged. Refer to the error code description information in this manual section.

AEC PCB LED status:

After the power on diagnostics, the AEC PCB LEDs DS2 and DS3 are lit successively. Any different status corresponds to an abnormal situation. An error code is logged. Refer to the error code description information in this manual section.